

## Subject Categories of the Division F. Life Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

**51 Life Sciences (General) 166**

**52 Aerospace Medicine 173**

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

**53 Behavioral Sciences 177**

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**54 Man/System Technology and Life Support 182**



Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also *16 Space Transportation*.

**55 Space Biology N.A.**

Includes exobiology; planetary biology; and extraterrestrial life.

## Subject Categories of the Division G. Mathematical and Computer Sciences

Select a category to view the collection of records cited. N.A. means no abstracts in that category.

- |           |   |            |
|-----------|---|------------|
| <b>59</b> | <b>Mathematical and Computer Sciences (General)</b>   | <b>185</b> |
| <b>60</b> | <b>Computer Operations and Hardware</b>   | <b>186</b> |
|           | Includes hardware for computer graphics, firmware, and data processing. For components see <i>33 Electronics and Electrical Engineering</i> .                                   |            |
| <b>61</b> | <b>Computer Programming and Software</b>  | <b>187</b> |
|           | Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.   |            |
| <b>62</b> | <b>Computer Systems</b>   | <b>196</b> |
|           | Includes computer networks and special application computer systems.  |            |
| <b>63</b> | <b>Cybernetics</b>  | <b>200</b> |
|           | Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also <i>54 Man/System Technology and Life Support</i> . |            |
| <b>64</b> | <b>Numerical Analysis</b>   | <b>202</b> |
|           | Includes iteration, difference equations, and numerical approximation.  |            |
| <b>65</b> | <b>Statistics and Probability</b>   | <b>205</b> |
|           | Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.   |            |
| <b>66</b> | <b>Systems Analysis</b>   | <b>205</b> |
|           | Includes mathematical modeling; network analysis; and operations research.  |            |
| <b>67</b> | <b>Theoretical Mathematics</b>  | <b>207</b> |
|           | Includes topology and number theory.  |            |

51  
**LIFE SCIENCES (GENERAL)**

**19970019305** Lawrence Livermore National Lab., Livermore, CA USA

**Elements in biological AMS**

Vogel, J.S., Lawrence Livermore National Lab., USA; McAninch, J., Lawrence Livermore National Lab., USA; Freeman, S., Lawrence Livermore National Lab., USA; Aug. 1996; 14p; In English; 7; International Accelerator Mass Spectrometry Conference, 20 - 24 May 1996, Tucson, AZ, USA

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): UCRL-JC-125170; CONF-9605169-6; DE96-050543; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

AMS (Accelerator Mass Spectrometry) provides high detection sensitivity for isotopes whose half-lives are between 10 years and 100 million years. C-14 is the most developed of such isotopes and is used in tracing natural and anthropogenic organic compounds in the Earth's biosphere. Thirty-three elements in the main periodic table and 17 lanthanides or actinides have long lived isotopes, providing potential tracers for research in elemental biochemistry. Overlap of biologically interesting heavy elements and possible AMS tracers is discussed.

DOE

*Mass Spectroscopy; Heavy Elements; Radiative Lifetime; Isotopes; Chemical Elements; Biochemistry*

**19970019376** Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD USA

**Performance Decrements in Constant Load Work for Specific Inspiratory and Expiratory Breathing Resistances *Final Report, Aug. 1994 - Mar. 1995***

Caretti, David M., Edgewood Research Development and Engineering Center, USA; Aug. 1996; 20p; In English

Contract(s)/Grant(s): DA Proj. 101-62622-A-553

Report No.(s): AD-A317875; ERDEC-TR-3439; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

This study developed estimates of work performance for specific levels of inspiratory and expiratory resistances. Exercise performance and subjective responses were measured in 5 volunteers during constant load, high intensity work under mask conditions of altered inspiratory resistance (I) and altered inspiratory and expiratory resistance (I+E). Mask performance ratings decreased approximately 17%, 25%, and 42% as inspiratory resistances were increased to 20 mm H<sub>2</sub>O, 30 mm H<sub>2</sub>O, and 40 mm H<sub>2</sub>O from the control mask level of 9 mm H<sub>2</sub>O and expiratory resistance was unaltered. When mask expiratory resistance was increased, performance decrements were 5%, 14%, and 34%, respectively. These observations emphasize the fact that even low levels of breathing resistance will impact performance. However, they also suggest that even slight reductions in the inspiratory and expiratory resistances of current negative pressure masks could improve wearer performance under physical stresses similar to the exercise intensity employed in this study.

DTIC

*Breathing Apparatus; Physical Exercise; Masks; Stress (Physiology)*

**19970019397** California Univ., San Diego, La Jolla, CA USA

**Skeletal Muscle Ischemia and Heat Shock Proteins *Final Report, 1 Jul. 1993 - 30 Jun. 1996***

Dillmann, Wolfgang H., California Univ., San Diego, USA; Jul. 1996; 35p; In English; 67th; Scientific Session of the American Heart Association, 14-17 Nov. 1994, Dallas, TX, USA

Contract(s)/Grant(s): DAMD17-93-J-3027

Report No.(s): AD-A318826; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Blood loss testing in decreased organ perfusion and subsequent ischemic injury of cardiac and skeletal muscle presents a significant problem for the soldier in combat. Recent findings indicate that different forms of noxious stress including exposure to increased temperature, noxious chemical agents, and ischemia lead to increased expression of heat shock proteins (hsp) which have a protective effect against injury induced by noxious stimuli. We wanted to determine in this proposal if a muscle derived permanent cell line expressing increased amounts of hsp70 will show protection against damage induced by simulated ischemia. to generate cell lines which permanently overexpress the inducible hsp70 (hsp70i) proteins, cells will be transfected with a neomycin resistance gene and the hsp70i gene. Stable lines will be selected by growing L6 cells in the presence of neomycin. Cells which have the neomycin resistance gene and the hsp70 gene incorporated into their DNA will survive. Such stably transfected cell lines will then be exposed to simulated ischemia consisting of hypoxia, absence of glucose, low tonicity, and resultant ischemic damage will be determined by quantitating cell viability measured in colony formation assays, the inhibition of protein synthesis, and the release of cytoplasmic enzymes like creatine kinase. These studies will determine if hsp70i exerts a protective effect

against ischemia mediated muscle injury. Demonstrating a protective effect of hsp70 protein will make it a useful agent to reduce ischemic muscle damage in soldiers exposed to muscle injury in combat.

DTIC

*Thermal Shock; Proteins; Ischemia; Musculoskeletal System; Cells (Biology)*

**19970019501** California Univ., San Diego, La Jolla, CA USA

**Molecular Recognition of Endocytic Codes in Receptor Tyrosine Kinases** *Final Report, 1 Jul. 1994 - 30 Jun. 1996*

Wu, Rui-Yun, California Univ., San Diego, USA; Gill, Gordon, California Univ., San Diego, USA; Jul. 1996; 50p; In English  
Contract(s)/Grant(s): DAMD17-94-J-4124

Report No.(s): AD-A315785; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Enigma, isolated based on interaction with the human insulin receptor (InsR) using a yeast two-hybrid system, contains three LIM domains within its carboxyl terminus. The carboxyl LIM domain (LIM3) specifically recognizes the endocytic codes of InsR. Interaction of two random peptide libraries indicates the specific binding of Gly-Pro-Hyr-Gly-Pro-Hyr-Tyr/Phe corresponding to the major endocytic code of InsR. The ability of LIM3 of Enigma to recognize the endocytic codes of InsR fulfills the first property of the endocytic mechanism. In contrast to LIM3 of Enigma binding to InsR, LIM2 of Enigma associates specifically with the tyrosine kinase receptor Ret. Mutational analysis indicated that Tyr(586) at the carboxyl terminus of Ret is essential for the Ret and Enigma interaction. Mutations of Ret/ptc2 which fail to interact with Enigma also lose their ability to stimulate mitogenic signaling. Co-expression of LIM domains of Enigma blocked Ret/ptc2 stimulated DNA synthesis, indicating that Enigma is involved in the mitogenic signaling of Ret. These studies have indicated that two LIM domains of Enigma can interact with two receptor tyrosine kinases through tyrosine-based motifs with specificity residing in both the LIM domains and in the target structures.

DTIC

*Deoxyribonucleic Acid; Carboxyl Group; Tyrosine*

**19970019522** Wake Forest Univ., Bowman Gray School of Medicine, Winston-Salem, NC USA

**Effect of Hormone Replacement Therapies and Dietary Phytoestrogens on the Mammary Gland of Macaques** *Annual Report, 1 Jul. 1995 - 30 Jun. 1996*

Cline, J. M., Wake Forest Univ., USA; Jul. 1996; 71p; In English

Contract(s)/Grant(s): DAMD17-94-J-4201

Report No.(s): AD-A315786; No Copyright; Avail: CASI; A04, Hardcopy; A01, microfiche

The purpose of this study was to use histomorphometric and immunohistochemical techniques to study the incidence and characteristics of mammary gland hyperplasia, dysplasia and other possible indicators of breast cancer risk, in cynomolgus macaques given long-term hormonal treatments. Treatments evaluated to date include conjugated estrogens (CEE), medroxyprogesterone acetate (MPA), the combination of CEE and MPA, tamoxifen, estradiol (E2), 17 alpha- dihydroequilenin (DHEN), soybean phytoestrogens (SBE), and SBE + E2. Pathologic evaluation, histomorphometric evaluations, and staining for estrogen receptor, progesterone receptor, and the proliferation marker Ki-67 MIB were done. Results are as follows: The addition of MPA to CEE therapy increases, rather than decreases, mammary gland proliferation. Tamoxifen treatment does not induce mammary gland proliferation beyond that seen in controls; this is in contrast to a marked uterotrophic effect. DHEN does not induce mammary gland or endometrial proliferation, relative to controls and in contrast to E2. Soybean estrogens do not induce mammary or endometrial proliferation when given alone, and exert an antagonistic effect on E2-induced proliferation in both sites. New work includes dietary modulation of-hormonal effects on mammary gland, identification of p53 expression in CEE-treated macaque mammary gland, and development of whole-mount techniques.

DTIC

*Hormones; Therapy; Cancer; Estrogens; Females; Mammary Glands*

**19970019528** Louisiana State Univ., Medical Center, Shreveport, LA USA

**Brucella HTRA Protein and Pathogenesis: Brucella HTRA Strains as Vaccines** *Annual Report, 1 Aug. 1995 - 31 Jul. 1986*

Roop, Roy M., Louisiana State Univ., USA; Aug. 1996; 26p; In English

Contract(s)/Grant(s): DAMD17-94-C-4054

Report No.(s): AD-A317300; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Bacterial stress response proteases of the high temperature requirement A (HtrA) family are thought to be an important component of cellular defense against oxidative damage through their capacity to degrade oxidatively damaged proteins. The results of studies described in a previous report confirmed that the Brucella HtrA contributes to the resistance of these intracellular pathogens to killing by host neutrophils and macrophages. Unfortunately, the attenuation of Brucella HtrA mutants is limited to the early

stages of infection in the mouse model, and this residual virulence prevents their use as vaccine candidates. Our current research is directed at introducing secondary mutations into the *B. abortus* and *B. melitensis* htrA mutants PHE1 and RWP5, respectively, which will both enhance and stabilize their attenuation in mice. Several mutations which offer promise in this regard have been identified, and the corresponding HtrA-based double mutants are presently being evaluated for biologically relevant in vitro phenotypes, virulence in BALB/c mice, and where appropriate, resistance to killing by cultured murine neutrophils and macrophages. Double mutants showing significant and stable attenuation in mice will be evaluated for their capacity to elicit protective immunity against challenge with the virulent *B. abortus* and *B. melitensis* parental strains.

DTIC

*Bacteria; Infectious Diseases; Vaccines; Pathogenesis; Proteins*

**19970019540** Michigan State Univ., Dept. of Crop and Soil Sciences, East Lansing, MI USA

**Attenuating Organic Contaminant Mobility by Soil Modification: Towards a Biologically Integrated Technology** *Final Report, 5 Jun. 1991 - 4 Jun. 1994*

Boyd, Stephen A., Michigan State Univ., USA; Crocker, Fiona H., Michigan State Univ., USA; Mueller, Sherry A., Michigan State Univ., USA; Xu, Shi-He, Michigan State Univ., USA; Nye, Jeffrey V., Michigan State Univ., USA; Dec. 13, 1995; 158p; In English  
Contract(s)/Grant(s): F08635-91-C-0173

Report No.(s): AD-A317184; AL/EQ-TR-1996-0002; No Copyright; Avail: CASI; A08, Hardcopy; A02, microfiche

Coupling the enhanced retention of Nonionic Organic Contaminants (NOCs) in quaternary ammonium (QUAT)-amended subsoils with bioremediation of the immobilized NOCs is being studied as a comprehensive soil restoration technology. Four areas were investigated: (1) QUAT binding to soils and subsoils, (2) QUAT biocompatibility with NOC-degrading microorganisms, (3) biostability of QUATs exchanged onto natural soils and clays, and (4) NOC bioavailability to indigenous microorganisms. HDTMA-clay complexes are chemically stable when hydrophobic HDTMA bonding is limited by lowering the ionic strength and controlling companion ions. HDTMA biostability can be increased by: (1) binding to clay exchange sites, (2) introduction to subsoils rather than surface soils and (3) maintaining saturated soil conditions. Although HDTMA is toxic to axenic cultures of bacteria, its toxicity is virtually eliminated by binding to clay minerals. Repopulation of the treated zone should occur once HDTMA is bound to soil.

DTIC

*Organic Materials; Ions; Mobility; Soils; Activity (Biology)*

**19970019566** Rochester Univ., Dept. of Chemistry, NY USA

**New Multilabel Fluorescent Groups for Increased Sensitivity of DNA Detection** *Final Report, 1993 - 1996*

Kool, Eric T., Rochester Univ., USA; Oct. 01, 1996; 8p; In English

Report No.(s): AD-A316448; ARO-31507.10-LS-YIP; No Copyright; Avail: CASI; A02, Hardcopy; A01, microfiche

The long-term goals of this project are to use oligonucleotides tagged with multiple fluorescent labels as hybridization probes of specific nucleic acid sequences. We have developed novel modes of binding between designed DNA probes and target DNA or RNA sequences, and we are investigating the combination of these new binding modes with dual (or more) fluorescent labels to raise signal intensity and signal-to-noise ratios. Such probes may be useful in detection and identification of pathogen nucleic acids as well as disease-related nucleic acid sequences in humans.

DTIC

*Deoxyribonucleic Acid; Nucleotides; Oligomers; Fluorescence*

**19970019615** Wisconsin Univ., Madison, WI USA

**Mapping Mammary Carcinoma Suppressor Genes in the Laboratory Rat** *Annual Report, 1 Jul. 1995 - 30 Jun. 1996*

Gould, Michael, Wisconsin Univ., USA; Lan, Hong, Wisconsin Univ., USA; Jul. 1996; 48p; In English

Contract(s)/Grant(s): DAMD17-94-J-4040

Report No.(s): AD-A315688; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Inbred strains of rats differ in their susceptibility to both spontaneous and chemically-induced mammary carcinoma formation. We are currently using molecular biology techniques combined with classical genetic breeding studies to try to identify the mammary carcinoma suppressor (MCS) gene(s) responsible for the mammary carcinoma resistance trait in inbred Copenhagen (Cop) and Wistar Kyoto (WKy) rats. Simple sequence repeat (SSR) markers from the literature as well as from our chromosome specific libraries were used to map the rat genome and fine-map the regions that involved in the resistance phenotype. Previous data identified a quantitative trait locus (QTL) on rat chromosome 2 which is linked to the resistance phenotype (the gene is termed *Mcs-1*), and a marker on rat chromosome 7 which also appeared linked to the resistance phenotype (the gene is termed *Mcs-2*). Since the last progress report, 27 additional markers have been placed on the chromosome 2 map. One marker, CA2.F1, increased

the LOD score to 4.154, further confirming the QTL at Mcs-1. Thirteen additional markers have been placed on the chromosome 7 map, and Mcs-2 is localized near a region on chromosome 7q13. Moreover, we found two other regions which show suggestive linkage to the resistance phenotype, one each on chromosomes 1 and 7.

DTIC

*Cancer; Chromosomes; Genes; Rats; Molecular Biology*

**19970019623** California Univ., San Diego, La Jolla, CA USA

**Alternative Splicing in Normal Development and in Breast Cancer Final Report, 1 Jul. 1994 - 30 Jun. 1996**

Birmingham, John R., California Univ., San Diego, USA; Jul. 1996; 20p; In English

Contract(s)/Grant(s): DAMD17-94-J-4106

Report No.(s): AD-A315689; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Alterations in the splicing patterns of key regulatory genes are likely to play an important role in oncogenesis. The ASF/SF2 protein is one of a family of SR splicing factors that have been shown to regulate splice site choice in vitro. We have mapped the ASF/SF2 gene to 17q21.3-q22 in humans, and close to the Ovum mutant locus on chromosome 11 in mice. Our current objective is to examine the role of the ASF/SF2 gene in development and oncogenesis by observing the effects of disrupting the gene in mice. We were unable to achieve germ line transmission using embryonic stem cells that were heterozygous for an ASF/SF2 deletion. Highly chimeric mice were runted, possessed hypotrophic testes, and were sterile. Because of the possibility that this result is due to haploinsufficiency of the ASF/SF2 gene, and in light of new data that suggest that ASF/SF2 may be required for cell viability, we are constructing an inducible knockout vector for the ASF/SF2 gene.

DTIC

*Mammary Glands; Cancer; Tumors*

**19970019624** Baylor Coll. of Medicine, Houston, TX USA

**Regulation of Agonist-- and Antagonist--Mediated Activation of Human Progesterone Receptors by Phosphorylation Annual Report, 1 Jul. 1995 - 30 Jun. 1996**

Zhang, Yi-Xian, Baylor Coll. of Medicine, USA; Jul. 1996; 20p; In English

Contract(s)/Grant(s): DAMD17-94-J-4202

Report No.(s): AD-A315692; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The human progesterone receptor (hPR) in breast cancer cells (T47D) is phosphorylated on multiple serine residues. I have previously reported the identification of eight phosphorylation sites. Here I show the identification of a new site, Ser20. This site is hPR-B specific and contains a Ser-Pro consensus sequence. The role of phosphorylation in hPR and RU 486 antagonist/agonist switch has also been investigated. Using a yeast system, the effect of B-specific phosphorylation on AF3 transactivation has been studied. Mutation of Ser102 to Ala nearly depleted the activity of AF3, suggesting that phosphorylation is a specific and an important regulatory step for hPR activity. I have also compared the activity of the mutant Ala400 with the wild type hPR. Surprisingly, the mutant's activity is significantly higher than that of the wild type, implying that regulation of hPR by phosphorylation is complex. Recently, several co-regulators of steroid receptors have been cloned and characterized. I have just begun to study their roles in the RU 486 antagonist/agonist switch. Initial results show that the PKA may potentiate the hPR activity through SRC-1. Whether SRC-1 can mediate the switch is under investigation.

DTIC

*Mammary Glands; Cancer; Females; Mutations; Phosphorylation; Steroids*

**19970019625** National Inst. for Occupational Safety and Health, Cincinnati, OH USA

**Breast Cancer Incidence in Occupational Cohorts Exposed to Ethylene Oxide and Polychlorinated Biphenyls Annual Report, 1 Aug. 1995 - 31 Jul. 1996**

Ward, Elizabeth M., National Inst. for Occupational Safety and Health, USA; Aug. 1996; 11p; In English

Contract(s)/Grant(s): MIPR-94MM4580

Report No.(s): AD-A315695; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

NIOSH is evaluating breast cancer incidence in two large study cohorts, which have been previously assembled. One of the cohorts includes approximately 10,000 women with exposure to ethylene oxide (ETO), a direct alkylating agent which produces mammary tumors in mice. The other cohort includes over 13,000 women exposed to polychlorinated biphenyls (PCBs), a group of chemicals suspected to be carcinogenic to the breast because of their lipophilic and estrogenic activities. Each cohort represents the largest and best defined female study cohort in the U.S. for the respective exposure. The primary activities for this year have



focused on establishing vital status and mailing addresses for individuals in the two study cohorts, and seeking OMB approval for the study questionnaires. Work to accomplish vital status and address identification is proceeding in a timely fashion.

DTIC

*Mammary Glands; Tumors; Females; Carcinogens; Cancer*

**19970019627** Brown Univ., Inst. for Brain and Neural Systems, Providence, RI USA

**BCM Network Develops Orientation Selectivity and Ocular Dominance in Natural Scene Environment**

Shouval, Harel, Brown Univ., USA; Intrator, Nathan, Brown Univ., USA; Cooper, Leon N., Brown Univ., USA; Oct. 18, 1996; 13p; In English

Contract(s)/Grant(s): N00014-91-J-1316

Report No.(s): AD-A316968; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

A two-eye visual environment is used in training a network of BCM neurons. We study the effect of misalignment, between the synaptic density functions connecting both eyes to each single neuron, on the formation of orientation selectivity and ocular dominance. The visual environment we use is composed of natural images. We show that for the BCM rule a natural image environment with binocular cortical misalignment is sufficient for producing networks with orientation selective cells and ocular dominance columns. This work is an extension of our previous single cell model.

DTIC

*Neurons; Eye (Anatomy); Misalignment; Connectors*

**19970019711** Columbia Univ., New York, NY USA

**The Role of Cyclin D1 Overexpression in Breast Cancer Progression Annual Report, 15 Jul. 1995 - 14 Jul. 1996**

Weinstein, I. Bernard, Columbia Univ., USA; Aug. 1996; 11p; In English

Contract(s)/Grant(s): DAMD17-94-J-4101

Report No.(s): AD-A317758; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

This project examines the role of cyclin D1, and related genes, in multistage breast carcinogenesis. It may provide new biomarkers and strategies for the prevention and treatment of breast cancer. During the past year two studies were completed and published. The first provides further evidence that increased expression of cyclin D1 can inhibit the growth of mammary epithelial cells. It can also increase the sensitivity of these cells to the induction of apoptosis by various agents. These effects appear to be due to increased levels of the cell cycle inhibitory protein p27kip1. The second study demonstrates that increased expression of cyclin E in mammary epithelial cells can also inhibit growth and that this is also due to increased expression of p27kip1. Breast cancer cell lines with increased expression of cyclins D1 and/or E also have high levels of p27kip1. Thus, mammary epithelial cells have a homeostatic feed-back loop that regulates the G1 to S progression of the cell cycle. Studies are in progress to evaluate the clinical relevance of these findings.

DTIC

*Mammary Glands; Cancer; Carcinogens*

**19970019752** Colorado State Univ., Anatomy and Neurobiology Dept., Fort Collins, CO USA

**Alterations in Nerve Terminal Arborization do not Correlate with Increased Synaptic Efficacy in the Lobster Neuromuscular Junction**

Schultz, Timothy P., Colorado State Univ., USA; Jan. 09, 1997; 54p; In English

Report No.(s): AD-A320124; AFIT-96-108; No Copyright; Avail: CASI; A04, Hardcopy; A01, microfiche

Neurotransmitter release is essential for chemical synaptic transmission, and the efficacy of synaptic transmission depends on how much transmitter is released from discrete sites in the axon terminal called active zones. The number and structural organization of active zones are important for governing synaptic efficacy, and may play a central role in synaptic plasticity. One method to enhance synaptic strength could be to expand the nerve terminal arborization to accommodate an increase in the number of active zones. The possibility that experimentally induced increases in synaptic efficacy correlate with increases in the amount of nerve terminal arborization is tested in this Master of Science Thesis. The lobster Distal Accessory Flexor Muscle (DAFM) is an excellent model for studying the relationship between synaptic efficacy and the structural organization of the presynaptic axon terminal. A single excitatory and inhibitory motor neuron innervate the DAFM, and the amount of transmitter they release is regionally differentiated. Regional differences in both the number and structure of active zones contribute to the regional differences in the amount of transmitter released.

DTIC

*Neuromuscular Transmission; Nerves; Correlation Detection*

**19970019753** Brigham and Women's Hospital, Boston, MA USA

**Cellular Proteins Interacting with the Tumor Suppressor Protein p53** *Annual Report, 15 Jul. 1995 - 14 Jul. 1996*

Chen, Jun-Jie, Brigham and Women's Hospital, USA; Aug. 1996; 30p; In English

Contract(s)/Grant(s): DAMD17-94-J-4070

Report No.(s): AD-A316821; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Tumor suppressor protein p53 interacts directly with the DNA replication factor RPA and inhibits its ability to bind single-strand-DNA. We defined the domain of p53 that bound to RPA and constructed p53 mutants that failed to bind RPA, but still functioned as transcriptional activators. We found that while these mutants of p53 lost their ability to bind RPA; they still maintained the growth suppression function of p53. Growth suppression function of p53 is dependent on its transactivation activity, probably by inducing p21 and other cell cycle inhibitors. We have extended our study to the p21 protein, which is induced by p53 and interacts with both the cdk2 kinase and a DNA replication factor PCNA. Here we have demonstrated the importance of PCNA-inhibitory domain of p21 in vivo. We have also shown that p21 has to interact directly with both cyclin subunit and cdk2 subunit of the cyclin-cdk complex in order to inhibit the kinase activity and suppress cell growth in vivo.

DTIC

*Tumors; Cell Division; Inhibitors; Mutations*

**19970019878** AScl Corp., Vicksburg, MS USA

**A Simulation Model for Growth of the Submersed Aquatic Macrophyte Hydrilla (Hydrilla Verticillata (L.f.) Royle)** *Final Report*

Best, Elly P., AScl Corp., USA; Boyd, William A., Corps of Engineers, USA; Sep. 1996; 96p; In English

Contract(s)/Grant(s): DACW39-90-D-0001

Report No.(s): AD-A317203; WES-TR-A-96-8; No Copyright; Avail: CASI; A05, Hardcopy; A01, microfiche

A simulation model for the biomass dynamics of the submersed macrophyte Hydrilla verticillata (dioecious biotype) is presented. The model HYDRIL is based on carbon flow within a 1-m<sup>2</sup> water column. It includes several aspects that affect biomass dynamics, such as latitude, seasonal changes in climate, pH and oxygen effects on CO<sub>2</sub> assimilation rate at light saturation, wintering strategies, grazing (removal of above ground and tuber biomass), and mechanical control (removal of above ground biomass). The characteristics of the community and of the site can be easily modified by the user. HYDRIL incorporates insights into the processes affecting the dynamics of a Hydrilla community in relatively shallow, hard water (0.1- to 2.5-m depth; DIC concentration greater than 0.8 mmol). It has been calibrated on data pertaining to a Hydrilla community in Lake Orange, Florida. At that site, no above ground wintering biomass is present and growth starts from the tuber bank. Peak biomass is reached late in August and tuber formation takes place in autumn, replenishing the tuber bank. HYDRIL simulates the dynamics of plant biomass and tuber bank density at Lake Orange well over a period of 1 to 5 years. It has been used to calculate plant biomass and tuber density for other sites in subtropical (Florida) and tropical (India) areas, where it simulated biomass ranges similar to those measured in the field.

DTIC

*Computerized Simulation; Plants (Botany); Aquatic Plants; India*

**19970020181** Federation of American Societies for Experimental Biology, Bethesda, MD USA

**Retinal Neurobiology and Visual Processing** *Final Report, 1 May 1996 - 30 Apr. 1997*

Copenhagen, David, Federation of American Societies for Experimental Biology, USA; Oct. 03, 1996; 27p; In English

Contract(s)/Grant(s): F49620-96-I-0128; AF Proj. 2313

Report No.(s): AD-A316945; AFOSR-TR-96-0529; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The sessions were organized as follows: (1) Visual Performance; (2) Signal Transduction and Modulation in ON Bipolar cells; (3) Mechanisms and Functions of Gap Junction Coupling; (4) Tonic Channels to Machines; (5) Synaptic Mechanisms in the Outer Plexiform Layer; (6) 'Potpourri'; (7) CABAC Receptors; (8) Synaptic Processes in the Inner Plexiform Layer; and (9) Ecology of Vision.

DTIC

*Visual Perception; Conferences; Neurophysiology; Photoreceptors*

**19970020198** Brown Univ., Physics Dept., Providence, RI USA

**Classification of Underwater Mammals using Feature Extraction Based on Time-Frequency Analysis and BCM Theory**

Huynh, Quyen Q., Brown Univ., USA; Cooper, Leon N., Brown Univ., USA; Intrator, Nathan, Brown Univ., USA; Shouval, Harel, Brown Univ., USA; May 1996; 15p; In English

Contract(s)/Grant(s): N00014-91-J-1316



Report No.(s): AD-A316962; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Underwater mammal sounds classification is demonstrated using a novel application of wavelet time/frequency decomposition and feature extraction using the BCM neuron. The system achieves outstanding classification performance even when tested with mammal sounds recorded at very different locations (from training).

DTIC

*Wavelet Analysis; Underwater Acoustics; Signal Detection; Neurons; Pattern Recognition*

**19970020203** Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

**Safety Testing of Venezuelan Equine Encephalitis Virus-Infected Mouse Brains Following Formalin-Fixation**

Ludwig, George V., Army Medical Research Inst. of Infectious Diseases, USA; Vogel, Peter, Army Medical Research Inst. of Infectious Diseases, USA; Sep. 16, 1996; 7p; In English

Report No.(s): AD-A316953; No Copyright; Avail: CASI; A02, Hardcopy; A01, microfiche

Immunocytochemical analysis of viral infections in animal tissues has become an important and necessary component of biomedical research. Use of this and other related techniques requires tissues to be fixed in formalin. The period of time to which tissues must be exposed to formalin must be carefully balanced between ensuring complete inactivation of any infectious agents present in the tissues and maintaining critical protein epitopes necessary for completing the analysis. In this paper we show that Venezuelan equine encephalitis (VEE) virus in mouse brains can be completely inactivated after only 3 days exposure to formalin. This represents a significant savings in time over the standard 21 days exposure currently required before mouse tissues can be removed from biocontainment suites. Studies on the pathogenesis of VEE virus in the mouse model may benefit from shorter formalin-exposure times by increasing the sensitivity of immunocytochemical analysis.

DTIC

*Infectious Diseases; Viruses; Encephalitis; Brain*

**19970020277** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**High Energy Slit Aperture Spect and Simplified Invitro Methods for the Dosimetry of Positron Emitting Radiotracers**

Wrobel, Mark C., Michigan Univ., USA; Jan. 09, 1997; 215p; In English

Report No.(s): AD-A319835; Rept-96-42D; No Copyright; Avail: CASI; A10, Hardcopy; A03, microfiche

The dosimetry of new positron emitting radiopharmaceuticals is initially estimated using animal tissue and organ biodistributions assessed invitro. Such methods are time and labor intensive and can have limited accuracy. This research investigated two alternative methods by which biodistribution can be obtained from the laboratory rat: invitro organ measurements using a reduced sacrifice technique, and invivo measurements using Single Photon Emission Computed Tomography (SPECT). As an alternative to a four time-point sacrifice method, a two time-point method was evaluated as a means to determine the organ cumulated activity of C labeled radiopharmaceuticals. Residence times calculated using two time-points acquired during the first half-life of C were either equivalent or larger than those resulting from using four sacrifice times. Correction factors were required for the urinary bladder and gallbladder when using this simplified technique due to delayed uptakes. Invivo assessments were performed with SPRINT, a full ring detector SPECT system using a slit aperture to obtain a 3-to-1 object to image magnification ratio. Acceptable resolution for 511 keV photons was achieved using a high energy parallel slice collimator and a novel technique to correct for penetration of the slit aperture by high energy photons. The resulting system resolution was approximately 4.5 mm axially and transaxially. System sensitivity was approx. 55 cpm/micronCi, a consequence of high resolution collimation and poor intrinsic detector efficiency.

DTIC

*Dosimeters; Positrons; Emission*

**19970020278** Massachusetts Univ., Lowell, MA USA

**Normal and Ischemic Myocardial Transport Kinetics for Bis(N-ethoxy, N-ethyl Dithiocarbamate) Nitrido Technetium-99m (NOET)**

Harms, Terrance A., Massachusetts Univ., USA; Jan. 09, 1997; 78p; In English

Report No.(s): AD-A320200; AFIT-96-134; No Copyright; Avail: CASI; A05, Hardcopy; A01, microfiche

Recently a new Tc-99m labeled compound bis(N-ethoxy, N-ethyl dithiocarbamate) nitrido Tc-99m, or NOET, has been designed to evaluate regional myocardial blood flow and cellular viability. Previous studies of NOET indicate that it has the potential for use as a perfusion agent for assessing myocardial viability. These studies however were not designed to evaluate the actual kinetics of this agent. In the present study, Thermoluminescent Dosimeter (TLD) analysis was used in a rabbit model to assess the transport kinetics of NOET in normal and ischemic myocardium. The final rate constants for clearance in the normal and ischemic regions were  $7.58E-4 \pm 1.1E-4$  (1 sigma) 1/min and  $9.59E-4 \pm 3.6E-4$  (1 sigma) 1/min, respectively. These compare to the arte-

rial clearance rate constant of  $4.81\text{E-}3 \pm 1.2\text{E-}3$  (1 sigma) 1/min. Therefore, findings indicate that NOET has the potential to assess myocardial viability.

DTIC

*Ischemia; Arteries; Myocardium; Blood Circulation; Radioactive Isotopes*

**19970020285** Brown Univ., Dept. of Physics, Providence, RI USA

**Time Dependence of Visual Deprivation: A Comparison between Models of Plasticity and Experimental Results**

Blais, Brian, Brown Univ., USA; Shouval, Harel, Brown Univ., USA; Cooper, Leon N., Brown Univ., USA; Oct. 07, 1996; 16p; In English

Contract(s)/Grant(s): N00014-91-J-1316

Report No.(s): AD-A316967; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Receptive fields in the visual cortex can be altered by changing the visual environment, as has been shown many times in deprivation experiments. In this paper we simulate this set of experiments using two different models of cortical plasticity, BCM and PCA. The visual environment used is composed of natural images for open eye and of noise for closed eyes. We measure the response of the neurons to oriented stimuli, and use the time course information of the neuronal response to provide a preliminary quantitative comparison between the cortical models and experiment.

DTIC

*Vision; Neurons; Eye (Anatomy); Models; Neurophysiology; Physiological Responses*

**19970020338** Yale Univ., School of Medicine, New Haven, CT USA

**Heregulin-Induced Growth Factor Receptor Signaling and Breast Carcinogenesis Annual Report, 1 Jul. 1995 - 30 Jun. 1996**

Riese, David J., II, Yale Univ., USA; Stern, David F., Yale Univ., USA; Jul. 1996; 31p; In English

Contract(s)/Grant(s): DAMD17-94-J-4036

Report No.(s): AD-A315700; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

We have engineered a panel of Ba/F3 cell lines that express, singly and in every pairwise combination, the four erbB family receptors. Using this panel of cell lines, we have evaluated hormone-induced erbB family receptor phosphorylation and coupling to downstream signaling proteins and physiologic responses. To date, we have tested six epidermal growth factor (EGF) family hormones: EGF, transforming growth factor alpha (TGF $\alpha$ ), heparin-binding EGF-like growth factor (HB-EGF), amphiregulin (AR), betacellulin (BTC), and neuregulin-beta (NRGB), also known as heregulin or neu differentiation factor. EGF, BTC, and NRGB exhibit distinct activities, while EGF, TGF $\alpha$  and HB-EGF are functionally equivalent. Furthermore, the four erbB family receptors exhibit differential coupling to cellular signaling proteins and physiologic responses. This suggests that cellular responses to activation of the EGF family/erbB family signaling network are specified by several hierarchical mechanisms.

DTIC

*Mammary Glands; Physiological Responses; Cells (Biology); Hormones; Cancer; Carcinogens*

## 52

### AEROSPACE MEDICINE

*Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.*

**19970019295** Agracetus, Inc., Middleton, WI USA

**A Novel DNA-Based Vaccine Methodology for AIDS Annual Report, 30 Sep. 1995 - 29 Sep 1996**

Haynes, Joel R., Agracetus, Inc., USA; Oct. 1996; 25p; In English

Contract(s)/Grant(s): DAMD17-94-J-4426

Report No.(s): AD-A318232; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Gene gun-based DNA immunization studies in mice using an HIV-1 gp120 expression vector demonstrated that modest effects on the strength and quality of gp120-specific immune responses could be elicited via the codelivery of vectors encoding murine IL-2, IL-7, or IL-12. However, much more dramatic effects on gp120-specific immune responses could be elicited by administering fewer immunizations over a longer time frame. In the nonhuman primate model, synergistic effects on the induction of HIV or SIV gp120-specific antibody titers were observed when gene gun immunizations were boosted with either recombinant subunit or recombinant vaccinia virus vaccines. In addition, a measurable vaccine effect was observed in rhesus macaques, in that lower virus loads and higher CD4 counts were observed in gene gun-vaccinated animals relative to naive controls following a heterologous challenge with SIVB670. Protection was not correlated with the strength of gp120-specific antibody titers. In the swine model, very strong humoral responses were observed in a three dose regimen using as little as 0.5  $\mu\text{g}$  of DNA per immuniza-

tion. These responses were equivalent to those elicited following administration of a commercial adjuvanted recombinant subunit vaccine.

DTIC

*Deoxyribonucleic Acid; Genes; Immune Systems; Human Immunodeficiency Virus; Vaccines; Physiological Responses*

**19970019405** North Carolina Univ., Dept. of Environmental Sciences and Engineering, Chapel Hill, NC USA

**A Model to Estimate A Worker's Exposure to Spray Paint Mists**

Carlton, Gary N., North Carolina Univ., USA; 1996; 199p; In English

Report No.(s): AD-A311669; AFIT-96-029D; No Copyright; Avail: CASI; A09, Hardcopy; A03, microfiche

Although local exhaust ventilation reduces exposure to airborne contaminants, current design methodology is limited because the relationship between exposure and ventilation is seldom known for a specific industrial operation. This research addressed this deficiency by introducing the notion of an empirical-conceptual model. These models relate exposure to ventilation through various process parameters responsible for the generation and transport of contaminants. To illustrate the modeling technique, an empirical-conceptual model of a spray painting task was developed. A conceptual model described three processes that determine the exposure: droplet formation, droplet transfer, and droplet transport. Each process was examined and important factors which characterize the processes identified. These factors were then grouped into four dimensionless variables using dimensional analysis. A laboratory set-up used a mannequin, flat plate and spray nozzle in a wind tunnel to find the functional relationship among these variables. The model indicates worker orientation to the freestream has a significant influence on breathing zone concentrations. The magnitude of the dimensionless quantity consisting of nozzle pressure, worker height, liquid viscosity, and freestream velocity determined in which orientation the concentration was higher. The influence of process parameters on the breathing zone droplet size

DTIC

*Wind Tunnel Tests; Sprayers; Paints; Personnel; Exposure*

**19970019547** Massachusetts Inst. of Tech., Research Lab. of Electronics, Cambridge, MA USA

**Mechanisms and Diagnostics of Ultrashort Pulse Laser Ocular Effects** *Final Report, 14 Apr. 1993 - 14 Apr. 1996*

Fujimoto, James G., Massachusetts Inst. of Tech., USA; Aug. 22, 1996; 12p; In English

Contract(s)/Grant(s): F49620-93-I-0301; AF Proj. 2312

Report No.(s): AD-A315376; AFOSR-TR-96-0458; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The objective of our program has been to investigate the mechanisms of short and ultrashort pulse laser retinal injury and to develop and apply new diagnostics for the assessment of retinal injury. A key focus of our effort during this program has been to develop and apply optical coherence tomography (OCT) to investigate the morphology of retinal laser injury. OCT is a new noninvasive optical diagnostic technique for micron scale cross sectional imaging, which can permit the noninvasive imaging of retinal microstructure in situ. Working in collaboration with investigators at Brooks AFB, we have applied OCT to study lesion structure, development, and healing response from laser retinal injury. An increased understanding of the mechanisms of laser retinal injury is relevant to the development of laser safety standards as well as the development and improvement of clinical laser therapies for ocular disease.

DTIC

*Laser Damage; Imaging Techniques; Tomography; Clinical Medicine; Nonlinear Optics; Pulsed Lasers; Morphology; Retina; Diagnosis; Eye (Anatomy)*

**19970019571** New York Univ. Medical Center, Lab. of Environmental Studies, New York, NY USA

**Suppression of Lymphocyte Signal Transduction by Oxygen Intermediates** *Annual Report, 30 Sep. 1995 - 29 Sep. 1996*

Flescher, Eliezer, New York Univ. Medical Center, USA; Oct. 1996; 27p; In English

Contract(s)/Grant(s): DAMD17-95-I-5058

Report No.(s): AD-A319847; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Oxidative stress alters the expression of transcription factors in human lymphocytes. Given the critical role these factors play in gene regulation, their abnormal regulation should lead to disturbances in gene expression and these in turn will result in cellular dysfunction. The transcription factor abnormalities may be used to develop an assay for the detection of environmental toxic oxidants. Technical objectives: to study three models of inducing oxidative stress in lymphocytes: 1) PAO activity generating extracellularly low levels of H<sub>2</sub>O<sub>2</sub> for two days (mimicking exposures to environmental chemical toxicants); 2) electron irradiation generating both extra and intracellularly mainly OH; and 3) high levels of reagent H<sub>2</sub>O<sub>2</sub> generating short but acute stress. The following questions were asked during the first year of work: Do human lymphocytes subjected to oxidative stress: 1) exhibit

abnormal cellular function-expression of transcription factors that regulate the interleukin 2 gene (essential for T lymphocyte function); and 2) sustain damage as assessed by an independent and established method.

DTIC

*Lymphocytes; Oxygen; Immune Systems*

**19970019593** Army Medical Research and Materiel Command, Fort Detrick, MD USA

**A Genetic Screen for Ligand Binding by the Human Estrogen Receptor** *Annual Report, 15 Aug. 1995 - 14 Aug 1996*

Nichols, Mark D., European Molecular Biology Lab., Germany; Sep. 1996; 36p; In English

Contract(s)/Grant(s): DAMD17-94-J-4103

Report No.(s): AD-A318810; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

FLP recombinase-steroid receptor fusion proteins convert ligand binding into DNA recombination. We describe a ligand responsive FLP - estrogen receptor binding domain (FLP-EBD) in yeast that accurately reflects known estrogen receptor agonist affinities. All tested estrogens, whether agonists or antagonists, induce FLP-EBD 251-595 recombination, indicating that all induce EBD release from the Hsp90 complex. Altering the distance between FLP and the EBD domains in the fusion protein affects ligand inducibility. A FLP-EBD 304-595, with 53 fewer amino acids, shows reduced inducibility by agonists, and unexpectedly, complete insensitivity to induction by all antagonists tested. Thus we observe a tethered interference between FLP and the EBD domains that differs depending on the distance between the two domains and the conformations induced by agonists or antagonists, presenting a distinction between estrogen agonists and antagonists in yeast. Combining this distinction with mutagenesis of the EBD has generated numerous mutations with altered ligand specificity, sometimes inverting the activation effects of hormones and antihormones. Further study will define the specific mechanisms leading to antihormone action, especially with respect to the therapeutically important antihormones, tamoxifen and raloxifene.

DTIC

*Deoxyribonucleic Acid; Amino Acids; Estrogens; Genetics; Steroids*

**19970019697** California Univ., Irvine, CA USA

**Structure/Function of Recombinant Human Estrogen Receptor** *Annual Report, 1 Sep. 1995 - 31 Aug. 1996*

Vickery, Larry E., California Univ., USA; Sep. 1996; 31p; In English

Contract(s)/Grant(s): DAMD17-94-J-4320

Report No.(s): AD-A320055; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Interaction of the estrogen receptor with its ligands is mediated by a C-terminal region of the protein designated the hormone binding domain (HBD) and residues within the HBD are thought to contribute to dimerization. To examine dimer interactions in the isolated HBD, a human estrogen receptor HBD fragment was expressed in high yield as a cleavable fusion protein in *Escherichia coli*. The isolated estrogen receptor HBD dimerizes and undergoes conformational changes associated with cooperative ligand binding in a manner comparable to the full-length protein, that the N-terminus of the HBD contributes to dimer interactions, and that one effect of ligand binding is to alter the dissociation kinetics of the receptor protein dimer. Current progress includes determination of ligand binding stoichiometry, development of an assay for examining dimer dissociation kinetics in solution, and construction and screening of several mutant proteins.

DTIC

*Hormones; Dimerization; Proteins; Assaying; Dissociation; Estrogens; Stoichiometry; Mammary Glands; Cancer*

**19970019911** Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada

**Current Trends in Decompression Development: Statistics and Data Analysis**

Nishi, R. Y., Defence and Civil Inst. of Environmental Medicine, Canada; Tikuisis, P., Defence and Civil Inst. of Environmental Medicine, Canada; Dec. 1996; 17p; In English

Report No.(s): AD-A320268; DCIEM-96-R-65; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Defence and Civil Institute of Environmental Medicine (DCIEM) has been involved in decompression research for over 30 years, and has successfully developed and validated a number of decompression tables for use by the Canadian Forces. These include decompression for air diving, surface-supported helium-oxygen diving, and self-contained semi-closed circuit rebreather diving for mine countermeasures. This article is a review of the traditional deterministic approach to decompression modelling and the newer probabilistic approach. The new approach to decompression modelling has the potential for developing safer and more efficient diving procedures and tables for CF diving applications. Since the development of the first decompression tables in 1906 by J.S. Haldane, considerable research and effort have been expended in the development of safer and more rapid decompression procedures and tables. Most models of decompression that have been used to generate decompression tables have taken a deterministic approach where the boundary between 'safe' and 'unsafe' dives is governed by a fixed set of rules, depending on



the gas exchange model and 'safe ascent' criterion that are selected. These models are essentially empirical and not physiological models, providing 'safe' decompression only over a limited range of depth and bottom times. Because Decompression Illness (DCI) is considered a binary event, it becomes logistically and financially impossible to conduct enough dives to show that a given dive profile is safe within statistical significance. DCI should actually be considered as a probabilistic event. Decompression profiles are not just a case of being 'safe' or 'unsafe' but should be considered as a time-depth dosage.

DTIC

*Decompression Sickness; Statistical Analysis; Data Processing; Breathing Apparatus; Gas Exchange*

**19970019949** Datamat Systems Research, Inc., McLean, VA USA

**Rapid Target Modeling Through Genetic Inheritance Mechanism Genetically Evolved Target Prototyping (GETP) Final Report, 7 May - 10 Dec. 1996**

Bala, Jerzy, Datamat Systems Research, Inc., USA; Pachowicz, Peter, Datamat Systems Research, Inc., USA; Gogia, B. K., Datamat Systems Research, Inc., USA; Dec. 10, 1996; 34p; In English

Report No.(s): AD-A320475; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

This report describes a Genetic Evolution Target Prototyping (GETP) methodology for rapid target model development and validation from limited initial sensory and technical data. The Phase I developed methodology generates new target signatures of a given target from an initial signature database by utilizing the power of genetic inheritance. Developed methodology allows for an expansion of the initial signature database and extensive testing of ATR systems over a variety of realistic signatures and situations not seen so far. The methodology utilizes a power of genetic inheritance to generate new signatures of a given target from a limited set of initial signatures. Initial signatures are represented by blob models. They are transformed into a string representation, a representation suitable for the genetic processing. The population of strings obtained from a starting set of signatures is subject to genetic evolution. Crossover and mutation operations are applied during each evolutionary cycle to generate new signatures. New signatures in the population are validated according to closeness to a tuning set of signatures. After a number of evolution cycles, signatures in the current population inherit significant resemblance from the initial and tuning subset of signatures and closely resemble signatures to be interpolated.

DTIC

*Genetic Engineering; Mutations; Prototypes*

**19970020114** Minnesota Univ., Minneapolis, MN USA

**Morphological Manifestations of Parvovirus B19 Infection in the Bone Marrow**

More, Lucia Ellen, Minnesota Univ., USA; Jan. 09, 1997; 62p; In English

Report No.(s): AD-A320226; AFIT-96-116; No Copyright; Avail: CASI; A04, Hardcopy; A01, microfiche

Parvovirus B19 (PV B19) preferentially infects erythroid progenitor cells in the bone marrow, frequently causing anemia along with transient aplastic crisis and pure red cell aplasia. The giant normoblast, previously described as the classic marrow finding, is not a highly sensitive indicator of infection. We devised a highly sensitive two-round, nested PCR procedure to detect PV B19. Eight of 78 clinical specimens from individuals with unexplained cytopenias which tested positive by this method, were studied to define the effects of this virus. Examination of the bone marrow of these patients revealed a spectrum of morphological manifestations including: the giant normoblast, hypocellular marrow, hypercellular marrow, interstitial depletion, red cell aplasia, erythroid hyperplasia and evidence of erythroid dysplasia. The heterogeneity of these findings may reflect atypical immune responses leading to a prolonged course in some patients.

DTIC

*Bone Marrow; Anemias; Erythrocytes; Infectious Diseases*

**19970020225** Air Force Inst. of Tech., National Air Intelligence Center, Wright-Patterson AFB, OH USA

**Injury Threshold of Cornea to CO2 Laser Light Exposure,**

Xu, Jie-Min, Academia Sinica, China; Hu, Fu-Gen, Academia Sinica, China; Zhou, Shu-Ying, Academia Sinica, China; Cao, Wei-Qun, Academia Sinica, China; Qian, Huan-Wen, Academia Sinica, China; Laser Journal; Oct. 02, 1996, pp. 739-741; In English; Translated into English by Leo Kanner Associates

Contract(s)/Grant(s): F33657-88-D-2188

Report No.(s): AD-A316938; NAIC-ID(RS)T-0498-96; No Copyright; Avail: CASI; A02, Hardcopy; A01, microfiche



The minimum visible lesion in the corneal epithelium resulting from exposure to sq cm laser light is carefully determined. The dose causing 50% probability of damage (ED50) varied with time of exposure. For 1.03 seconds it was 7.52 W/sq cm (95% CL 5.8-5.85 W/sq cm) and for 0.12 seconds it was 10.7 W/sq cm (95% CL 10.4-10.9 W/sq cm)

DTIC

*Carbon Dioxide Lasers; Exposure; Cornea; Time Dependence; Physiological Effects*

**19970020314** Empirical Technologies Corp., Charlottesville, VA USA

**Biological Sensors and Multiorgan Diagnostic Screening Physiographic Personnel Monitor. Phase 1 Final Report, 28 Mar. -27 Sep. 1996**

Baruch, Martin C., Empirical Technologies Corp., USA; Adkins, Charles M., Empirical Technologies Corp., USA; Gerdt, David W., Empirical Technologies Corp., USA; Oct. 1996; 26p; In English

Contract(s)/Grant(s): DAMD17-96-C-6035

Report No.(s): AD-A317282; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The Phase I effort has established the feasibility of a heartbeat and respiration sensor with high sensitivity, based on a fiber optic coupler that will fit within the dimensions of a wrist watch. Radio frequency transmission tests have demonstrated the feasibility of using a custom designed IC with on-board antenna and driver circuitry to transmit the sensor's low frequency signal to a receiver unit over a distance of one meter or more at frequencies of 220 - 420 Mhz. Electronic interface units were constructed that contain the circuitry necessary for opto-electronic conversion as well as to perform the sum and difference calculations to isolate the heartbeat-related changes in the sensor's output signal. A laptop-based AID data acquisition system was implemented.

DTIC

*Feasibility; Heart Rate; Fiber Optics*

**19970020350** Virginia Univ., Virginia Neurological Inst., Charlottesville, VA USA

**Integrated Remote Neurosurgical System Annual Report, 14 Aug. 1995 - 13 Aug 1996**

Kassell, Neal F., Virginia Univ., USA; Downs, J. Hunter, III, Virginia Univ., USA; Sep. 1996; 14p; In English

Contract(s)/Grant(s): DAMD17-95-1-5060

Report No.(s): AD-A317024; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The Neurovisualization Lab at the University of Virginia is currently developing the Integrated Remote Neurosurgical System (IRNS) to allow remote neurosurgical procedures for access to underserved localities. The system allows a remote neurosurgeon to control a robotic microscope through the use of 3-D input devices, communicate through live audio and video over an ATM switch, and view presurgical imagery. The surgical team in the operating room will also have access to the same images and communication facilities. The system will also serve as a training tool through the use of a complete robotic simulation we have developed. We have also instituted safety precautions in the form of restriction of robot motion, monitoring of robot joints, and protocol of system use. We have developed a registration system to assist in the implementation of these guidelines. A task analysis has led to development of a prototype user interface, and the preliminary integration of available components has been completed. We report on the current state of the system and ongoing development with respect to the user interface and intergrations

DTIC

*Remote Control; Robotics; Medical Equipment; Robots; Robot Dynamics; Computer Techniques; Computer Programs*

## 53

### BEHAVIORAL SCIENCES

*Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.*

**19970019330** Rutgers - The State Univ., Piscataway, NJ USA

**Space Perception with Normal and Prosthetic Vision Final Report, 1 May 1994 - 30 Apr. 1996**

Hadani, Itzhak, Rutgers - The State Univ., USA; Julesz, Bela, Rutgers - The State Univ., USA; Dec. 23, 1996; 204p; In English

Contract(s)/Grant(s): F49620-94-I-0262; AF Proj. 2313

Report No.(s): AD-A320014; SR-4-26395; AFOSR-TR-97-0048; No Copyright; Avail: CASI; A10, Hardcopy; A03, microfiche

This report encompasses: (1) A unique and metric solution for the differential equations that specify the optic-flow of monocularly navigating observer; (2) A report on a correlation between individual differences in interocular distance and registered depth in random dot stereogram with and without pedestal disparities; (3) Expansion on a navigational approach to space perception - SPIN theory - which suggests that object constancy is obtained during fixations by pure passive navigation computations, and across saccades by a combination of ocular and vestibular signals. It is suggested that the VOR constraints the rotational and veloc-

ity components of the eye to be perpendicular; (4) Analysis of the degree of uncertainty offered by the inferential, direct, and computational approaches in cognitive psychology as illustrated by their window metaphors. Visual stability in normal and prosthetic vision is examined and leads to newly stated magnification and distance paradoxes. A telescope metaphor, which is a modified Mach-Gibson visual-ego metaphor with a zooming feature, is suggested as a model that can resolve the paradoxes; and (5) A computer system which simultaneously displays motion parallax yoked to head movement and binocular disparity, with measurements of the virtual parallax evoked by head movements in static RDS.

DTIC

*Space Perception; Computer Vision; Image Processing; Head Movement; Motion Perception*

**19970019602** Illinois Univ. at Urbana-Champaign, Inst. of Aviation, Savoy, IL USA

**Transfer of Training Effectiveness of Personal Computer-Based Aviation Training Devices *Final Report***

Taylor, Henry L., Illinois Univ. at Urbana-Champaign, USA; Lintern, Gavan, Illinois Univ. at Urbana-Champaign, USA; Hulin, Charles L., Illinois Univ. at Urbana-Champaign, USA; Talleur, Donald, Illinois Univ. at Urbana-Champaign, USA; Emanuel, Tom, Illinois Univ. at Urbana-Champaign, USA; Phillips, Sybil, Illinois Univ. at Urbana-Champaign, USA; May 1997; 28p; In English

Contract(s)/Grant(s): DTFA-94-G-044

Report No.(s): DOT/FAA/AM-97/11; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The training effectiveness of Personal Computer-Based Aviation Training Devices (PCATD's) has received only limited testing. In the experiment reported here, a commercially available PCATD was evaluated in a transfer of training experiment for its effectiveness in supporting instrument flight training. The data show levels of savings in airplane flight time that varied from 15% to over 40% for certain training exercises. However, there were also cases in which savings were essentially zero or even showed decrements as high as 25%. In general, transfer savings were positive and substantial when new tasks were introduced. The data indicate that a PCATD can provide training benefit for certain tasks but, in addition, use of the PCATD in some areas is not expected to result in savings and will erode the overall potential to reduce costs.

Author

*Transfer of Training; Training Devices; Computer Assisted Instruction; Flight Training*

**19970019606** Armstrong Lab., Williams AFB, AZ USA

**Reasons for Implementing Modeling and Simulation Technologies in Specialized Undergraduate Pilot Training *Final Report, Mar. - Sep. 1995***

Mattoon, Joseph S., Armstrong Lab., USA; Dec. 1995; 29p; In English

Contract(s)/Grant(s): AF Proj. 1123

Report No.(s): AD-A316977; AL/HR-TR-1995-0078; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

An investigation of Specialized Undergraduate Pilot Training (SUPT) within the U.S. Air Force's Air Education and Training Command (AETC) revealed some major challenges to effective and efficient pilot training. The implementation of modeling and simulation technologies and associated training methods were proposed as potential solutions to address these challenges. Solutions included a proficiency-tracking system that advances students as a function of individual performance; desktop simulation trainers to improve dynamic cognitive skills, high-fidelity flight simulators with stand-alone, network, and full visual field-of-view capabilities; and the installation of a flight recording system that can record training events during aircraft sorties and reproduce the events in a simulated format for subsequent debriefing and simulator training. The proposed methods and technologies are discussed in the context of theoretical principles and empirical findings of human factors, cognitive psychology, and educational technology research.

DTIC

*Human Factors Engineering; Training Simulators; Pilot Training; Cognitive Psychology*

**19970019611** Armstrong Lab., Wright-Patterson AFB, OH USA

**Optimal Personnel Assignment: An Application to Air Force Pilots *Interim Report, Feb. - Dec. 1993***

Siem, Frederick M., Armstrong Lab., USA; Alley, William E., Armstrong Lab., USA; Mar. 1996; 17p; In English

Contract(s)/Grant(s): AF Proj. 7719; AF Proj. 1123

Report No.(s): AD-A316975; AL/HR-TP-1996-0003; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

A study was conducted to examine the potential utility of optimally assigning Air Force pilots to training tracks without benefit of actual training outcomes. The resulting assignment solution indicated that (a) there was sufficient agreement among pilots

to form coherent selection policies that differed across types of aircraft, and (b) mean predicted performance could be improved about one-third standard deviation relative to random allocation. Follow-up research is discussed.

DTIC

*Aircraft Pilots; Flight Crews*

**19970019618** Advanced Scientific Concepts, Inc., Pittsburgh, PA USA

**A Conceptual Model of Metacognitive Skills** *Final Report, 11 Jun. 1993 - 11 Apr. 1994*

Geiwitz, James, Advanced Scientific Concepts, Inc., USA; Jun. 1996; 22p; In English

Contract(s)/Grant(s): MDA03-93-C-0109

Report No.(s): AD-A317176; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Little is known about the cognitive skills used by high-level commanders and executives in problem solving. 'Metacognitive' skills are abilities to monitor and direct the operation of cognitive skills. The author offers a summary of theories of metacognitive skills, including theories of intelligence, intellectual development in children and adults, and metamemory. Metacognitive skills that have been identified in the context of problem solving are discussed. A conceptual model is presented, starting with a model of problem solving and moving on to aspects of monitoring and control (technical, temporal, social, organizational). Implications for training and assessment are discussed, as well as issues of level of abstraction and how to represent the influence of metacognitive skills on human performance (flowchart vs. layered model).

DTIC

*Problem Solving; Intelligence; Human Beings; Children*

**19970019628** Galaxy Scientific Corp., Lackland AFB, TX USA

**An Experimental Approach to Teaching and Learning Probability: Stat Lady** *Interim Report, Feb. - Dec. 1993*

Shute, Valerie J., Galaxy Scientific Corp., USA; Gawlick-Grendell, Lisa A., Galaxy Scientific Corp., USA; Apr. 1996; 18p; In English

Contract(s)/Grant(s): F41622-92-D-0006; AF Proj. 2313

Report No.(s): AD-A316969; AL/HR-TP-1996-0004; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

This paper describes Stat Lady -- an experimental approach to teaching and learning probability based on the postulate that learning is a constructive process, fostered by an experimental learning environment that is anchored in real-world problems. Two experiments are discussed, comparing learning from Stat Lady vs. more traditional approaches -- classroom lecture, and paper-and-pencil workbook. Findings showed that Stat Lady learners performed at least as well on the outcome tests as the Lecture and Workbook groups despite the presence of many factors strongly favoring the traditional conditions. In some cases, Stat Lady subjects greatly exceeded the performance of the other groups.

DTIC

*Education; Instructors; Knowledge; Learning*

**19970019877** Department of Defense Polygraph Inst., Fort McClellan, AL USA

**Event-Related Potentials: The P300 and Self-Referent Stimuli** *Final Report, Aug. 1993 - Oct. 1995*

Ingram, Eben M., Department of Defense Polygraph Inst., USA; Oct. 1995; 37p; In English

Report No.(s): AD-A317251; DODPI94-P-0001; DODPI94-R-0006; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

This was an exploratory study designed to assess the effect of self-referent stimuli on the P300 component of the electroencephalogram (EEG). The stimuli were self-referent phrases. Self-referent phrases are phrases that are personally descriptive, and are, therefore, considered to be personally relevant. Personal relevance was manipulated through the truthfulness of the self-referent phrases. The EEG was examined for the occurrence of the P300 wave of the human event-related brain potential. The P300 is a positive wave of the EEG that occurs 300 milliseconds after the onset of an eliciting stimulus. The P300 was examined for any effects on its amplitude having to do with the truthfulness of the stimuli. The EEG activity was recorded from 20 male subjects who were presented visual stimuli on a computer monitor. The stimuli consisted of five true and five false self-referent phrases. The two-word phrases were repeatedly presented in random order for a total of 300 presentations (150 presentations of the true and 150 of the false). The probability of occurrence of each of the two classes of stimuli was 0.50. The subjects were required to do nothing except read the stimuli. Results indicate that both true and false self-referent stimuli elicited clearly identifiable P300s. The difference between P300 amplitudes elicited by true and false stimuli, however, was not significant (p greater than .05).

DTIC

*Electroencephalography; Psychophysiology; Neural Nets; Stress (Psychology); Psychological Tests; Neurophysiology; Deception*

**19970019956** Civil Aeromedical Inst., Oklahoma City, OK USA

**The Use of Task-Specific Lenses by Presbyopic Air Traffic Controllers at the En Route Radar Console *Final Report***

Nakagawara, Van B., Civil Aeromedical Inst., USA; Wood, Kathryn J., Civil Aeromedical Inst., USA; Dec. 1996; 23p; In English  
Report No.(s): AD-A320284; DOT/FAA/AM-96/27; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The configuration of the radar console to control aircraft traffic has similar features to a Visual Display Terminal (VDT) work station. Task-specific lenses have been found in clinical studies to reduce visual symptoms while working at the VDT. The American Optical Corporation TruVision Technica, a task-specific lens design, was evaluated to see if visual benefits from such a lens could be transferred from the VDT environment to the radar console work environment. Presbyopic Air Traffic Control Specialists (ATCSs) at the Houston Air Route Traffic Control Center were fitted with two prescription spectacles, using their current and Technica lens designs, in similar ophthalmic frames. Each ATCS used both lens designs at the radar console and provided subjective evaluations of their appropriateness in that environment. Thirteen (13) subjects (45.6 +/- 5.9 years of age, range 36-55 years) completed the study. Subjects who used larger near viewing area (single vision and executive) lens designs generally preferred their current lens design. The Technica was preferred by mature presbyopes (add power of greater than or equal to 1.25 diopters) and those using smaller near viewing area (FT-25, FT-28 and general progressive addition) lens designs. The primary complaints reported by ATCSs with the Technica were peripheral distortion and limited field of view. Task-specific lens designs are an alternative for presbyopic ATCS who work at a radar console. However, distortion and limited field of view from the lens may require prolonged adaptation times before such designs are acceptable to ATCS on the job, especially for those accustomed to lens designs with larger viewing areas.

DTIC

*Air Traffic Controllers (Personnel); Cathode Ray Tubes; Lenses; Display Devices*

**19970020224** Pennsylvania Univ., Dept. of Neuroscience, Philadelphia, PA USA

**Modeling Neural Mechanisms of the Control of Respiration *Progress Report, 1 Apr. 1993 - 31 Mar. 1996***

Schwaber, James S., Pennsylvania Univ., USA; Mar. 31, 1996; 4p; In English

Contract(s)/Grant(s): AF Proj. 2304

Report No.(s): AD-A316930; AFOSR-TR-96-0541; No Copyright; Avail: CASI; A01, Hardcopy; A01, microfiche

We have developed computational models of biological neural mechanisms that provide the genesis and control of network oscillations, specific patterns of oscillation, and the control of different phases in the patterns. These models are built up across several levels of biological complexity theory, beginning with individual ionic channel kinetics and ending in whole system behavior, and are grounded in accurate biological detail at every level. A major contribution of these models in the area of complexity theory, since it is possible to observe in simulation by which the interactions in these biological nonlinear dynamic systems produce emergent properties which are greater than the sum of their parts. The understanding of the interactions is leading to the ability to manipulate the behavior of these nonlinear dynamics systems. In some models each neuron class is represented by a population 25 neurons, and manipulation of these networks is leading to important insights in the area of biological parallel processing. All of these results are finding interest for applications within process technology and process control, as algorithms or as inspiration for novel approaches to nonlinear control problems.

DTIC

*Mathematical Models; Neural Nets; Nervous System; Respiration*

**19970020283** Armstrong Lab., Manpower and Personnel Research Div., Brooks AFB, TX USA

**A Path Model of U.S. Air Force Pilot Training and its Antecedents *Interim Report, Oct. - Jul. 1995***

Ree, Malcolm J., Armstrong Lab., USA; Carretta, Thomas R., Armstrong Lab., USA; Teachout, Mark S., Armstrong Lab., USA; Journal of Applied Psychology; Dec. 1995; Volume 80, No. 6; 24p; In English

Contract(s)/Grant(s): AF Proj. 7719

Report No.(s): AD-A317514; AL/HR-TP-1995-0034; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

A causal model of the role of general cognitive ability and prior job knowledge in subsequent job knowledge acquisition and work sample performance during training was developed. Participants were 3,428 Air Force officers in pilot training. The measures of ability and prior job knowledge came from the Air Force Officer Qualifying Test. The measures of job knowledge acquired during training were derived from classroom grades. Work sample measures came from check flight ratings. The causal model showed that ability directly influenced the acquisition of job knowledge. General cognitive ability influenced work samples through job knowledge. Prior job knowledge had almost no influence on subsequent job knowledge, but directly influenced the



early work sample. Early training job knowledge influenced subsequent job knowledge and work sample performance. Finally, early work sample performance strongly influenced subsequent work sample performance.

DTIC

*Pilot Training; Cognitive Psychology; Knowledge; Mental Performance*

**19970020305** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Procrastination as a Predictor of Job Performance**

Dutschmann, Steven L., Air Force Inst. of Tech., USA; Sep. 1996; 109p; In English

Report No.(s): AD-A319395; AFIT/GTM/LAR/96S-5; No Copyright; Avail: CASI; A06, Hardcopy; A02, microfiche

It is generally accepted that everyone puts off or delays doing tasks to some extent; however, little is known about how different styles affect job performance. Individual differences in goal orientation (tendency to set goals and objectives), conscientiousness (thoroughness and carefulness in performing a task), autonomy (freedom, independence, and discretion in scheduling work), and temperament (manner of thinking, behaving, and reacting) may have an influence on how efficiently and effectively people prioritize their tasks (or avoid tasks), and thus have an effect on job performance. This study examined the possible importance of procrastination in the workplace, and its effect on job performance. A measure of work-related procrastination was designed and a model was developed that proposed a linkage between individual differences and job performance. Two hypotheses were developed to test the implications of the model. The first hypothesis was supported - goal orientation, conscientiousness, autonomy, and temperament were significant predictors of work procrastination (task-avoidant behavior) in this study. The second hypothesis was not supported - results of analyses showed that procrastination was not a predictor of job performance in this study.

DTIC

*Human Performance; Productivity; Motivation*

**19970020333** State Univ. of New York, Dept. of Psychology, Stony Brook, NY USA

**AASERT93. Listener Based Factors in Perception Final Report, 1 Sep. 1993 - 31 Aug. 1996**

Samuel, Arthur G., State Univ. of New York, USA; Sep. 1996; 2p; In English

Contract(s)/Grant(s): F49620-93-I-0517; AF Proj. 3484

Report No.(s): AD-A317136; AFOSR-96-0525TR; No Copyright; Avail: CASI; A01, Hardcopy; A01, microfiche

Work was completed on Lee Wurm's dissertation. This project examined the auditory processing of prefixed English words in order to test competing models. One group of models states that morphologically complex words must be decomposed prior to lexical access, while another states that they need not be. Mixed models have also been proposed. In Experiment 1 potential stimulus items were rated along various continua by approximately 120 subjects. These ratings were used in regression analyses in two subsequent experiments. In Experiments 2-3 recognition performance data were collected using a gating paradigm and a lexical decision paradigm (38 and 110 subjects, respectively). Overall, uniqueness points and frequency measures corresponding to full form prefixed words were much better predictors of performance than were measures corresponding to work roots. These results support a continuous processing strategy.

DTIC

*Auditory Perception; Signal Processing; Regression Analysis; Semantics; Auditory Signals; Words (Language)*

**19970020432** Institute for Human Factors TNO, Soesterberg, Netherlands

**Visual Illusions: Various Examples Final Report Visuele Zinsbegoocheling: Een Aantal Voorbeelden**

Wertheim, A. H., Institute for Human Factors TNO, Netherlands; Apr. 15, 1997; 20p; In Dutch

Contract(s)/Grant(s): A92/KLu/331

Report No.(s): TD97-0191; TM-97-A029; Copyright; Avail: Issuing Activity (TNO, Human Factors Research Inst., Kampweg 5, 3769 De Soesterberg, The Netherlands), Hardcopy, microfiche

A number of illusions is listed, related to the unreliability of visual perceptual processes involved in proper situation awareness and spatial orientation of pilots in flight. In addition many relatively simple demonstrations are proposed to illustrate these illusions and visual problems. They can be added as a module to the disorientation demonstration program which is already available to air force flying personnel.

Author

*Visual Observation; Illusions*



## MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

*Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.*

**19970019327** Armstrong Lab., Systems Research Branch, Brooks AFB, TX USA

**Relationship Between Selected Measures of Physical Fitness and Performance of a Simulated Fire Fighting Emergency Task Interim Report, Jan. 1984 - Sep. 1996**

Myhre, Loren G., Armstrong Lab., USA; Tucker, Donald M., Armstrong Lab., USA; Bauer, Daniel H., Armstrong Lab., USA; Fisher, Joseph R., Jr., Armstrong Lab., USA; Grimm, Wade H., Air Force Civil Engineering Support Agency, USA; Tattersfield, Charles R., Exeter Univ., UK; Jan. 1997; 22p; In English

Contract(s)/Grant(s): AF Proj-7184

Report No.(s): AD-A319915; AL/CF-TR-1996--143; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Two hundred and seventy-nine (males, n=272; females, n=7) career fire fighters between the ages of 19 and 58 volunteered for this study to determine the relationship between selected measures of physical fitness and performance of a standardized, strenuous task simulating fire fighting emergency activities. This task required the fire fighter to enter a military dormitory, proceed to the third floor, crawl 38.5 yds to reach a 170-lb victim, and drag him back to safety (the stairwell); time (min:sec) to completion was the performance criterion. Measures of cardiorespiratory fitness (VO2 max), muscular strength, and body composition were analyzed in an attempt to identify the fitness factors which contributed most to successful task performance. Age and all measures of fitness were found to be significantly correlated with performance. The time required to complete this task vs. VO2 max (n=222) averaged 6:17 and 39.4 ml/kg/min, respectively. The top 25 percent (n=56) and the bottom 25 percent (n=55) performer's times and VO2 max averaged 3:15 and 45.5 ml/kg/min, and 11:42 and 34.1 ml/kg/min, respectively. A regression model was presented which provides a reasonably good prediction of task performance as a function of percent body fat, strength, and VO2 max.

DTIC

*Physical Fitness; Human Performance; Fire Fighting; Emergencies*

**19970019570** Analytic Sciences Corp., San Antonio, TX USA

**Scratch Resistance Testing of Pilot Helmet Visors Using a New Scratch Resistance Tester Final Report, Mar. 1994 - Mar. 1995**

Maier, Dennis A., Analytic Sciences Corp., USA; Dec. 1996; 38p; In English

Contract(s)/Grant(s): F33615-92-C-0017; AF Proj. 2830

Report No.(s): AD-A320493; AL/OE-TR-1996-0140; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The causes for removing pilot helmet visors from service were investigated as part of the Armstrong Laboratory's Advanced Aircrew Vision Protection (AAVP) program. The purpose of the investigation was to identify the factors which limit visor service life so that better technologies, specifications, or procedures could be developed and applied to the laser eye protection (LEP) visors being transitioned to the Human Systems Center (HSC) under the AAVP program. It was determined that the single cause of visor degradation which resulted in removing it from service was scratches in or delamination of the surface hardcoating (Reference AL/OE-TR-1996-0117, Failure Mechanisms in Pilot Helmet Visors). It was found that no specific scratch resistance requirements or specifications are applied to pilot helmet visors. Abrasion resistance and coating adhesion are specified in MIL-V-43511C and MIL-C-83409 but not scratch resistance. A new apparatus, the Maier Scratch Resistance Tester (MSRT), for testing the scratch resistance of optical coatings was invented and two prototype Maier scratch resistance testers (MSRTs) were fabricated. These testers were used to test the scratch resistance of pilot helmet visors from three different manufacturers. The tests on the visors were performed by two different operators, using two different MSRTs with one type of stylus. The tests described here were the initial tests performed with the new MSRT apparatus and had the following objectives: (1) to investigate the repeatability and consistency of the results obtained by different operators and for different MSRTs; and (2) to establish baseline scratch resistance characteristics, values, and variability for existing hard coatings which are used on Air Force pilot helmet visors.

DTIC

*Helmets; Wear Resistance; Antireflection Coatings; Visors; Test Equipment*

**19970019604** Hughes Training, Training Operations, Inc. Mesa, AZ USA

**Image Update Rate Can Affect the Perceived Speed of Simulated Self-Motion Final Report, Jun. 1992 - May 1995**

Lindholm, Julie M., Hughes Training, USA; Askins, Timothy M., Hughes Training, USA; Sisson, Norwood, Hughes Training, USA; Jun. 1996; 49p; In English

Contract(s)/Grant(s): F41624-95-C-5011; AF Proj. 1123

Report No.(s): AD-A316971; AL/HR-TR-1995-0194; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The update rate of an image generator affects the spatiotemporal representation of a time-varying scene and thus, potentially, an observer's percept during observation of the display image. In the first part of this report, we discuss image generation technology and sampling theory, and we present an analysis of the temporal frequencies in a space-time image representing constant-velocity, constant-altitude flight over a flat, textured terrain. In the second part, we report the results of two experiments in which a two-alternative, forced-choice method of constant stimuli was used to investigate the effects of image update rate (30 Hz vs 60 Hz) on the perceived speed of self motion. We found that perceived speed was higher with the lower update rate when the original image, internal to the computer, contained very high temporal frequencies, and the display image, therefore, contained a large number of spatiotemporal frequencies, within the bandpass of the human visual system, which had the wrong drift direction.

DTIC

*Very High Frequencies; Velocity; Terrain*

**19970019928** Systems Research Labs., Inc., Dayton, OH USA

**The Effects of Various Anti-G Suit Pressures and Positive Pressure Breathing on Lung Volumes as Measured by Spirometry at +1 Gz Final Report, Feb. 1990 - Dec. 1995**

Tripp, Lloyd D., Jr., Systems Research Labs., Inc., USA; Larsen, Robert, Wright State Univ., USA; Jul. 1996; 41p; In English  
Contract(s)/Grant(s): AF Proj. ILIR

Report No.(s): AD-A320273; AL/CF-TR-1996-0134; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Anti-G Suits have historically been evaluated using G-tolerance as the primary benchmark of a G-suit's effectiveness. One area which has been overlooked for over fifty years of G-suit design, is the effect of G-suit inflation on lung volumes. Lung inflation to about 75 percent of normal capacity is the key to producing the optimum intrathoracic pressure for performing the anti-G straining maneuver. This study evaluated three separate GH-suit designs, at +1 Gz and looked at the effect positive pressure breathing (PPB) had on maintaining lung volumes during G-suit inflations to 4, 6, and 8 psi. Lung volumes were measured using a microprocessor based spirometer. Results showed that the full pressure suit design (APS) had the smallest effect on inspiration. But in a comparison of the standard G-suit (trousers), the full coverage trousers (ATA0S) proved to be superior in design compared to the standard five bladder suit (CSU-13B/P). At suit pressures of 8 psi, Forced Inspiratory Vital Capacity (FIVC) percent change from baseline values for the APS, ATAGS, and CSU-13B/P were 80, 93, and 60% respectively. When PPB was added, FIVC values were 102, 66, and 46% respectively. These data show that the addition of PPB with anti-G suit trousers becomes a liability to lung function while the full pressure suit condition benefits by the addition of PPB. The use of pulmonary function testing as a means of determining the effect G-suit inflation has on lung volumes may prove to be useful in designing and evaluating the next generation of anti-G protection ensembles.

DTIC

*Flight Clothing; Breathing Apparatus; Spirometers; Pressure Suits*

**19970019934** Armstrong Lab., Crew Systems Directorate, Wright-Patterson AFB, OH USA

**Tactile Feedback for a Force-Reflecting Haptic Display Final Report, Jan. - Dec. 1995**

Hasser, Christopher J., Armstrong Lab., USA; Dec. 1995; 112p; In English  
Contract(s)/Grant(s): AF Proj. 2300

Report No.(s): AD-A320274; AL/CF-SR-1996-0134; No Copyright; Avail: CASI; A06, Hardcopy; A02, microfiche

This thesis describes the development of custom-built tactile feedback hardware and its integration with an available force-reflecting haptic interface. Design requirements were motivated strongly by the characteristics of the human tactile sense as well as the biomechanical characteristics of the human finger. The work explores the feasibility of various actuators, and selects a small solenoid actuator for application in a closed-loop force control tactile feedback system. An adaptive PI algorithm using continuously variable gain scheduling helps to compensate for nonlinearities in the solenoid actuator. The system demonstrates adequate closed-loop control, but the mass added to the force-reflecting haptic interface proves less than optimal. Design suggestions for future prototypes may reduce the mass added by the tactile feedback hardware by over 30%. The work concludes with recommendations for psychophysical research that will increase understanding of human performance in tasks using haptic feedback devices.

DTIC

*Feedback Control; Hardware; Design Analysis; Fingers; Touch*

**19970020223** Armstrong Lab., Human Resources Directorate, Mesa, AZ USA

**The Future of Selective Fidelity in Training Devices Final Report, Jun. 1994 - Nov. 1995**

Andrews, Dee H., Armstrong Lab., USA; Carroll, Lynn A., Armstrong Lab., USA; Bell, Herbert H., Armstrong Lab., USA; E-

educational Technology; Mar. 1996; Volume 6, No. 35, pp. 32-36; In English; 16th; Interservice/Industry Training Systems and Education, 28 Nov. - 1 Dec. 1994, Orlando, FL, USA

Contract(s)/Grant(s): AF Proj. 2743

Report No.(s): AD-A316902; AL/HR-TR-1995-0195; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Since the inception of modern simulation, the designers and users of training devices have attempted to replicate as many physical and functional stimuli as possible in the training device. There are three primary impediments to this activity: our frequent inability to specify the kinds of stimuli that are required, our technological difficulty in replicating some stimuli, and the cost of replicating stimuli. The constraints cited above have led the training device community to develop the concept of selective fidelity, meaning that we have to be very selective about the stimuli that we choose to replicate. This report presents arguments that our definitions of selective fidelity now need to be altered to fit recent behavioral and engineering developments. Over the years, we have improved our ability through research and analysis to define the important stimuli. Also, our engineering capability to replicate formerly difficult stimuli has improved significantly. Finally, there have been dramatic decreases in the cost of providing high fidelity simulation. In this report, we discuss our belief that while the concept of selective fidelity will remain important to the training device community, the definition of selective fidelity will be more focused on trainee learning requirements than on analytical and technological shortcomings.

DTIC

*Human Factors Engineering; Flight Simulators; Training Devices; Flight Training*

**19970020342** Institute for Human Factors TNO, Soesterberg, Netherlands

**Anthropometry of High School Graduates Final Report Antropometrische steekproef onder HAVO/VWO schoolverlaters**

Daanen, H. A. M., Institute for Human Factors TNO, Netherlands; Oudenhuijzen, A. J. K., Institute for Human Factors TNO, Netherlands; Werkhoven, P. J., Institute for Human Factors TNO, Netherlands; Jan. 22, 1997; 45p; In Dutch

Contract(s)/Grant(s): A95/KL/370

Report No.(s): TM-97-A007; TD-96-0514; Copyright; Avail: Issuing Activity (Inst. for Human Factors TNO, Soesterberg, Netherlands), Hardcopy, microfiche

Within the NATO community, in particular the tall North Europeans would benefit from adjustment of the current design criteria. Therefore, the TNO Human Factors Research Institute conducted a survey to measure the body dimensions of high school students in their senior year to update the database of body dimensions for the Royal Netherlands Air Force. The Royal Air Force uses this database to select the population from which their recruits are chosen. Twelve percent of the measured population of 549 students would have been rejected because of the current selection on the lengths of : stature, sitting height and buttock-knee length. Most students were rejected because their stature was less than the selection criterion: about 17 percent of the females measured less than 1630 mm. Forty percent were rejected if at least one parent was of non-Dutch origin. None of the males had a stature of less than 1630 mm, but 9 percent exceeded one of the criteria limits. It is recommended to add minima for sitting height and buttock-knee length since a small sitting height may lead to impaired vision on the instruments and environment and the adjustability range of the chair may be insufficient to accommodate people with a short buttock-knee length. Therefore, there is a good reason to incorporate anthropometry in evaluation of flight decks and flight deck designs and to convince manufacturers that current design criteria are often outdated.

Derived from text

*Anthropometry; Body Size (Biology); Males; Females; Pilot Selection; Pilots (Personnel)*

**19970020439** Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Inst. for Nutrition and Food Research, Zeist, Netherlands

**Feasibility of formulating extended and long storage stable bread for rations Haalbaarheid van het formuleren van verleugd-en lang houdbaar brood voor rantsoenen**

Jurgens, A., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Maarschalkerweerd, T. V. P., Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Netherlands; Jan. 1997; 28p; In Dutch

Contract(s)/Grant(s): A95/KL/116

Report No.(s): TNO-V96.611; TD97-0051; Copyright; Avail: Issuing Activity (TNO Nutrition and Food Research Inst., Zeist, Netherlands), Hardcopy, microfiche

The feasibility of the development of loaf with extended (one week) and long (one year) storage stability has been investigated. A literature search revealed the possibility of alternative formulations. Experimental work showed that high fat levels (4 - 8%) together with an emulsifier and a maltodextrine reduced crumb hardening markedly. Sensory perception, however was doughy. A separate sensory evaluation is recommended. With respect to long shelf life loaves, a US military specification for rolls has been examined. A high level of glycerol is used in the formulation to avoid microbiological activity. A high HLB sucrose ester

is used to reduce crumb hardening. The formulation needs a high quality flour with about 15% protein. Furthermore a minimum of 35 kJ/kg(dough) of mixing energy is required for dough development. Further optimization of the mixing and dough handling is recommended. The storage properties of the loaves were examined over a period of 9 months while packed in multi layered material under CO<sub>2</sub>. No microbiological activity was found. Crumb hardening was highly reduced by the sucrose ester. Compared to a standard Dutch type sensory properties deviate greatly. Formulation costs are 4 times higher.

Author

*Feasibility; Storage Stability; Rations; Combat; Food*

## 59

### MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

**19970019609** Naval Research Lab., Marine Geosciences Div., Bay Saint Louis, MS USA

**Survey of Spatial Topology: Issues and Approaches** *Final Report*

Arctur, David K., Florida Univ., USA; Alexander, John F., Florida Univ., USA; Chung, Miye J., Naval Research Lab., USA; Cobb, Maria A., Naval Research Lab., USA; Shaw, Kevin B., Naval Research Lab., USA; Sep. 20, 1996; 15p; In English  
Report No.(s): AD-A315673; NRL/MR/7441--96-7719; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

This report documents our current experience and understanding with respect to the design of the Object Oriented Vector Product Format prototype viewer/editor application for managing graphical primitive objects and operations while maintaining full spatial topology. This is an interim progress report within the Object-Oriented Database Exploitation Within the Global Geospatial Information and Services (GGIS) Data Warehouse project, sponsored by the Defense Mapping Agency (DMA). The goal of the overall project is to investigate, through research and prototyping efforts, the potential impact of object oriented technology on DMA's GGIS modernization program.

DTIC

*Topology; Surveys*

**19970019687** Argonne National Lab., IL USA

**STENMIN: A software package for large, sparse unconstrained optimization using tensor methods**

Bouaricha, A., Argonne National Lab., USA; [1996]; 20p; In English; Limited reproducibility: More than 20% of this document may be affected by microfiche quality

Contract(s)/Grant(s): W-31109-ENG-38

Report No.(s): MCS-P-451-0794; DE97-001073; No Copyright; Avail: Issuing Activity (Department of Energy (DOE)), microfiche

We describe a new package for minimizing an unconstrained nonlinear function where the Hessian is large and sparse. The software allows the user to select between a tensor method and a standard method based upon a quadratic model. The tensor method models the objective function by a fourth-order model, where the third- and fourth-order terms are chosen such that the extra cost of forming and solving the model is small. The new contribution of this package consists of the incorporation of an entirely new way of minimizing the tensor model that makes it suitable for solving large, sparse optimization problems efficiently. The test results indicate that, in general, the tensor method is significantly more efficient and more reliable than the standard Newton method for solving large, sparse unconstrained optimization problems.

DOE

*Applications Programs (Computers); Newton Methods; Tensors*

**19970019723** Princeton Univ., Dept. of Mechanical and Aerospace Engineering, NJ USA

**AASERT: Mathematical Library Software for Applications of Parallel Supercomputers** *Final Report, 1 Sep. 1992 - 31-Jan. 1996*

Orszag, Steven A., Princeton Univ., USA; Jul. 31, 1996; 4p; In English

Contract(s)/Grant(s): F49620-92-J-0425; AF Proj. 9821

Report No.(s): AD-A313219; AFOSR-TR-96-0426; No Copyright; Avail: CASI; A01, Hardcopy; A01, microfiche

This work involved a broad spectrum of applications of parallel computers to scientific computing. The students who worked on this project developed advanced methods for the direct numerical simulation of near-wall turbulence, techniques for large-scale data base analysis of turbulent flows, and advanced methods for the solution of wave propagation problems in complex media. All these applications involve substantial computer memory, data access, and in many cases computer resources that would not



be accessible except through parallel processing. The details of the work performed is presented in the publications and theses of the students supported.

DTIC

*Applications Programs (Computers); Parallel Processing (Computers); Data Bases*

**19970019744** Texas Univ., Austin, TX USA

**Hp-Adaptive Finite Element Methods for Time Dependent Problems with Applications to Stress Waves in Solids** *Final Report, 15 Jun. 1992 - 14 Jun. 1996*

Oden, J. T., Texas Univ., USA; Aug. 1996; 4p; In English

Contract(s)/Grant(s): DAAL03-92-G-0253

Report No.(s): AD-A316861; ARO-30297.9-MA; No Copyright; Avail: CASI; A01, Hardcopy; A01, microfiche

The general goals of this project included the development of new, high-order, adaptive methods for the computer simulation of stress-wave propagation phenomena in solid mechanics, particularly elastodynamics. The motivation for using adaptive methodologies is to control and optimize the computational process, to use a posteriori error estimates to optimize meshes and spectral orders of approximation. Such orchestrated meshing can produce exponential rates of convergence, thereby allowing complex simulations to be done using orders-of-magnitude fewer unknowns than standard methods.

DTIC

*Finite Element Method; Solid Mechanics; Stress Waves; Computerized Simulation; Time Dependence; Wave Propagation*

**19970020232** Chicago Univ., Dept. of Statistics, Chicago, IL USA

**Deformable Topological Templates for Image Analysis** *Final Report, Sep. 1992 - Aug. 1996*

Amit, Yali, Chicago Univ., USA; Aug. 10, 1996; 7p; In English

Contract(s)/Grant(s): DAAL03-92-G-0322

Report No.(s): AD-A316810; ARO-30167.15-MA; No Copyright; Avail: CASI; A02, Hardcopy; A01, microfiche

The main achievements of this proposal has been the introduction of a new family of global but sparse image features consisting of geometric arrangements of local responses. These features can serve as building blocks for template models, allowing for explicit modeling of the variability of the object family, and efficient computation of the template match. These features can also be accessed through decision trees to provide very accurate and efficient shape classifiers.

DTIC

*Image Processing; Topology; Tomography; Image Analysis*

## 60

### COMPUTER OPERATIONS AND HARDWARE

*Includes hardware for computer graphics, firmware, and data processing. For components see 33 Electronics and Electrical Engineering.*

**19970019365** Draper (Charles Stark) Lab., Inc., Cambridge, MA USA

**Cache Analysis in a Multiprocess Environment Using Execution Driven Simulation**

Fraser, John H., III, Northeastern Univ., USA; Jan. 09, 1997; 189p; In English

Report No.(s): AD-A319880; AFIT-96-121; No Copyright; Avail: CASI; A09, Hardcopy; A02, microfiche

Cache memory is commonly used to bridge the gap between microprocessor and memory speeds. A wide variety of cache designs are possible, so some method is required to evaluate the benefits and costs of the various alternatives. Trace driven simulation is commonly used by the computer architecture community to analyze potential designs. Traces of benchmark execution are applied to a model of the design under study. Most of today's computer systems have been optimized based on results of these studies. One important aspect that is frequently ignored in trace driven studies is the effect of the operating system and multiprogramming on cache performance; most traces consist only of a single program's execution. It has been acknowledged in the past that this overhead introduces interference which limits the benefits of new designs, but evaluations using multiprogrammed traces have been neglected due to the lack of readily available tools that can capture such traces. In this research we describe a new tracing system that allows the capture of both operating system and multiprogrammed execution data. Cache performance is studied using multiprogrammed traces of the SPEC benchmarks. We study the effects of considering multiple tasks on the cache miss rate. The performance variation is primarily due to the presence of context switches. In an attempt to extend this work, we develop an analytical model that is used to synthetically incorporate context switches into a single process trace. We have found that the operating system introduces a small but persistent overhead to cache performance. Additional processes have an even greater impact, which



increases as the level of multi-tasking increases. Spatial locality is not significantly affected by these conditions, but the temporal locality of a program is substantially reduced by the presence of context switches.

DTIC

*Computerized Simulation; Architecture (Computers); Microprocessors; Computers; Memory (Computers)*

**19970019640** Oregon State Univ., Corvallis, OR USA

**High-Performance Data-Parallel Input/Output**

Moore, Jason A., Oregon State Univ., USA; Jul. 19, 1996; 201p; In English

Report No.(s): AD-A318922; AFIT-96-058; No Copyright; Avail: CASI; A10, Hardcopy; A03, microfiche

First-generation commercial multiple-CPU computers provided little support for parallel disk I/O, either in terms of a high-performance parallel disk system or a reasonable programming interface. Today, advances in disk arrays, coupled with the striping of data across powerful I/O nodes, provide the means for systems such as the Thinking Machines CM-5, Intel Paragon, Meiko CS-2, and IBM SP-2 to provide reasonable disk bandwidth to parallel applications. Unfortunately, disk bandwidth is necessary, but not sufficient, to support parallel I/O operations. Existing parallel file systems are proving inadequate in two important arenas: programmability and performance. Both of these inadequacies can largely be traced to the fact that nearly all parallel file systems evolved from UNIX and rely on a UNIX-oriented, single-stream approach to file I/O. More researchers are agreeing that this approach is not ideal for supporting multiprocessor systems. In this dissertation, these issues are addressed in the context of distributed memory parallel computers like the SP-2 and CS-2. The processors on such a machine are connected by a fast network, and parallel file access is provided by a subset of processors acting as I/O nodes. File data are striped across the I/O nodes, which can communicate with each other and the remaining (compute) nodes using the parallel network.

DTIC

*Input/Output Routines; Parallel Processing (Computers); Parallel Computers; Massively Parallel Processors*

## 61

### COMPUTER PROGRAMMING AND SOFTWARE

*Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.*

**19970019285** Defence Science and Technology Organisation, Salisbury, Australia

**HaL's DCE Cell Manager: An Evaluation**

McClure, B., Defence Science and Technology Organisation, Australia; May 1996; 23p; In English

Report No.(s): AD-A311529; DSTO-TN-0040; DODA-AR-009-694; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

This report describes an evaluation of the Cell Manager, a software product from HaL Software, which simplifies the tasks of managing and administering a DCE cell.

DTIC

*Computer Programs; Distributed Processing; Systems Management*

**19970019298** George Mason Univ., Fairfax, VA USA

**Object-Oriented Formulations for Particle-in-Cell (pic) Plasma Final Report, 1 Sep. 1992 - 31 Aug. 1996**

Rine, David, George Mason Univ., USA; Aug. 31, 1996; 7p; In English

Contract(s)/Grant(s): F49620-92-J-0478; AF Proj. 2301

Report No.(s): AD-A318450; AFOSR-96-0551TR; No Copyright; Avail: CASI; A02, Hardcopy; A01, microfiche

During this period we completed the development of a World Wide Web version of the: Users Manual, Developers Manual, and the Algorithm Manual. Because this is a new generation PIC code, an online manual version was considered appropriate. The on-line Web site for the OOPIC manuals is: <http://ptsg.eecs.berkeley.edu/~peter/manuals.html>. In producing a high level design of the OOPIC software, the Object Modeling Technique (OMT) has been used. In constructing the Object Model view, the researchers have broken up the software into two major models, PIC and CUI. The PIC, or physics content model implements the scientific computations needed to run PIC simulations. The GUI module, represents the MS-Windows software that interacts with the user. The principal reason why OOPIC was made an object-oriented PIC code in C++ is to allow physicists to add new models to the code while at the same time not having to worry about changing the other 99% of the source code.

DTIC

*Software Engineering; Object-Oriented Programming; Graphical User Interface*

**19970019301** Naval Research Lab., Washington, DC USA

**Evolving Fuzzy Logic Control Strategies using SAMUEL: An Initial Implementation**

Cobb, Helen G., Naval Research Lab., USA; Grefenstette, John J., Naval Research Lab., USA; Sep. 06, 1996; 40p; In English  
Report No.(s): AD-A317388; NRL/MR/5510--96-7888; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Many control systems have been successfully implemented using fuzzy logic, which provides a systematic method for reasoning about uncertainty using expressions found in natural language. This paper describes an extension of the SAMUEL learning system to include fuzzy logic. SAMUEL is a learning system that uses genetic algorithms and other learning methods to evolve refined rules from an initial set of rules provided by the user. In this initial implementation, SAMUEL searches for the rules making up a fuzzy knowledge base (that is, a control strategy), given the user's definition of the fuzzy variables, the values that the variables can take on, and the fixed membership functions associated with the fuzzy values. The genetic algorithm searches for the combinations of rules that make up effective strategies, including the level of generality expressed by the rules. An example is provided showing how to learn fuzzy rules for evasive maneuvers.

DTIC

*Genetic Algorithms; Natural Language (Computers); Machine Learning*

**19970019310** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**CMM(sm), Version 1.1, Measurement Map Final Report**

Park, Robert E., Carnegie-Mellon Univ., USA; Oct. 1996; 61p; In English  
Contract(s)/Grant(s): F19628-95-C-0003

Report No.(s): AD-A318186; CMU/SEI-96-SR-003; No Copyright; Avail: CASI; A04, Hardcopy; A01, microfiche

This report identifies and tabulates all references to software measures and measurement activities that appear in Version 1.1 of the Capability Maturity Model for Software (CMM). Each reference is listed in a structured format, and the results are sorted into topic areas in a way that is designed to help organizations plan the evolution of their measurement activities across the key process areas of the CMM. Where the CMM's guidance is unclear or incomplete, opportunities for improving the CMM are noted and explained.

DTIC

*Computer Programs; Data Acquisition; Data Transfer (Computers)*

**19970019366** Delta Information Systems, Inc., Horsham, PA USA

**Scanned Images Final Report**

Perschau, Stephen, Delta Information Systems, Inc., USA; Jan. 1996; 83p; In English  
Contract(s)/Grant(s): DCA100-91-C-0031

Report No.(s): AD-A319888; NCS-TIB-96-2; No Copyright; Avail: CASI; A05, Hardcopy; A01, microfiche

The purpose of this project was to continue the work that began in the previous year toward the achievement of an ITU-T test image recommendation. As a result of comments and suggestions to the imagery contained on the first test CD ROM titled 'Standard Image Set, Beta Test CD-01', a second test CD-ROM was created for the ITU-T. This report describes this new test CD-ROM and the images contained on it; provides the standards groups who received evaluation copies of the test CD-ROM; contains a description of the images contained in the 'JPEG Continuation-tone Test Image Set'. This set of images was used in the performance evaluation of nine different proposed JPEG compression algorithms. The performance results obtained using the different JPEG algorithms on these images is given in this report. It also gives recommendations for further work in this area. The NCS has been a leader in the development and promulgation of standardized imagery for facsimile. The NCS has sponsored the digitization of documents at resolutions of 200, 240, 300, 400, 480, 600, and 800 lines per inch. This data has been used extensively in the study of standard compression of facsimile recommendations. These recommendations are of considerable value to the US Government.

DTIC

*Images; Digital Techniques; Standardization; Imagery; Algorithms; Facsimile Communication*

**19970019367** Naval Postgraduate School, Dept. of Computer Science, Monterey, CA USA

**A Type Inference Algorithm and Transition Semantics For Polymorphic C**

Oezgen, Mustafa, Naval Postgraduate School, USA; Sep. 1996; 126p; In English  
Report No.(s): AD-A318845; No Copyright; Avail: CASI; A07, Hardcopy; A02, microfiche

In an attempt to bring the ML-style type inference to the C programming language, Smith and Volpano developed a type system for a dialect of C, called PolyC SmV96a SmV95b. PolyC extends C with ML-style polymorphism and a limited form of higher-order function. Smith and Volpano proved a type soundness theorem that basically says that evaluation of a well-typed PolyC

program cannot fail due to a type mismatch. The type soundness proof is based on an operational characterization of a special kind of semantic formulation called a natural semantics. This thesis presents an alternative semantic formulation, called a transition semantics, that could be used in place of the natural semantics to prove type soundness. The primary advantage of the transition semantics is that it eliminates the extra operational level, but the disadvantage is that it consists of many more evaluation rules than the natural semantics. Thus it is unclear whether it is a suitable alternative to the two-level approach of Smith and Volpano. Further, the thesis gives the first full type inference algorithm for the type system of PolyC. Despite implicit variable dereferencing found in PolyC, the algorithm turns out to be a rather straight-forward extension of Damas and Milner's algorithm W DaM82. The algorithm has been implemented as an attribute grammar in Grammatech's SSL and a complete source code listing is given in the Appendix.

DTIC

*User Manuals (Computer Programs); C (Programming Language); Operating Systems (Computers)*

**19970019369** Naval Postgraduate School, Monterey, CA USA

**Survey of User Authentication Mechanisms**

Magno, Marianna B., Naval Postgraduate School, USA; Sep. 1996; 74p; In English

Report No.(s): AD-A318942; No Copyright; Avail: CASI; A04, Hardcopy; A01, microfiche

The use of a password as the only traditional user authentication mechanism has been criticized for its weakness in computer security. One problem is for the user to select short, easy to remember passwords. Another problem is the selection of a password that is too long which the user tends to forget. Long passwords tend to be written down carelessly somewhere in the work space. Such practices can create serious security loopholes. Consequently, this is a survey of alternative password mechanisms and other improved devices that are now available in the marketplace to enhance computer security. It taxonomizes the existing inventory of user authentication mechanisms such as biometrics, challenge/response, password, smart card and token.

DTIC

*Computer Information Security; Surveys*

**19970019378** Naval Postgraduate School, Monterey, CA USA

**Correlation in Multiversion Software, Jan. - Sep. 1996**

Jayachandran, Toke, Naval Postgraduate School, USA; Oct. 1996; 14p; In English

Report No.(s): AD-A317886; NPS-MA-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

It has been established both theoretically and experimentally that independently developed redundant software versions fail dependently. Several probability models that account for this phenomenon of concurrent failures have appeared in the literature. Tomek et al., proposed an intensity distribution that introduced a specific type of correlated failure pattern viz., pairwise correlation between software modules. They derived the intensity pmf for  $N = 2$  and 3 modules and indicated the desirability of an efficient algorithm to compute the pmf for larger values of  $N$ . This paper contains an easily programmable algorithm to generate the pmf for any choice of  $N$ .

DTIC

*Computer Programs; Algorithms; Correlation; Redundancy; Failure; Probability Theory*

**19970019519** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Cleanroom Software Engineering Implementation of the Capability Maturity Model (CMMSM) for Software *Final Report***

Linger, Richard C., Carnegie-Mellon Univ., USA; Paulk, Mark C., Carnegie-Mellon Univ., USA; Trammell, Carmen J., Tennessee Univ., USA; Dec. 1996; 104p; In English

Contract(s)/Grant(s): F19628-95-C-0003

Report No.(s): AD-A320485; CMU/SEI-96-TR-023; ESC-TR-96-023; No Copyright; Avail: CASI; A06, Hardcopy; A02, microfiche

Cleanroom software engineering is a theory-based engineering process for development and certification of high-reliability software systems under statistical quality control. Cleanroom is intended to help software organizations improve their ability to apply engineering discipline to software development. Cleanroom is defined in terms of 14 processes that implement the technology and operations involved in Cleanroom software development. This report defines the Cleanroom software engineering implementation of the Capability Maturity Model for Software. The definition is expressed in terms of a mapping of the 14 Cleanroom processes into the 18 CMM key process areas.

DTIC

*Software Engineering; Software Reliability*

**19970019523** Sandia National Labs., Albuquerque, NM USA

**Parallel contact detection algorithm for transient solid dynamics simulations using PRONTO3D**

Attaway, S.W., Sandia National Labs., USA; Hendrickson, B.A., Sandia National Labs., USA; Plimpton, S.J., Sandia National Labs., USA; Gardner, David R., Sandia National Labs., USA; Vaughan, Courtenay T., Sandia National Labs., USA; Heinstein, Martin W., Sandia National Labs., USA; Peery, James A., Sandia National Labs., USA; 1996; 17p; In English; 1996 International Mechanical Engineering Congress and Exhibition, 17 - 22 Nov. 1996, Atlanta, GA, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-96-0593C; CONF-961105-7; DE96-010972; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

An efficient, scalable, parallel algorithm for treating material surface contacts in solid mechanics finite element programs has been implemented in a modular way for MIMD parallel computers. The serial contact detection algorithm that was developed previously for the transient dynamics finite element code PRONTO3D has been extended for use in parallel computation by devising a dynamic (adaptive) processor load balancing scheme.

DOE

*Parallel Processing (Computers); Solid Mechanics; Finite Element Method; Algorithms*

**19970019557** Mitre Corp., Bedford, MA USA

**Real-Time Parallel Software Design Case Study: Implementation of the RT-2DFFT Benchmark on the MasPar MP-X Architecture Final Report, Mar. 1994 - Jun. 1995**

Koester, David P., Mitre Corp., USA; Rushanan, Joseph J., Mitre Corp., USA; Oct. 1996; 97p; In English

Contract(s)/Grant(s): F19628-94-C-0001; AF Proj. MOIE

Report No.(s): AD-A319067; RL-TR-96-167; No Copyright; Avail: CASI; A05, Hardcopy; A02, microfiche

The MITRE real time embedded scalable high performance computing benchmarking concept was extended and tested by implementing the Real Time-Two Dimensional Fast Fourier Transform (RT-2DFFT) benchmark on the Maspar MP-X series of massively parallel processors (MPPs). The RT-2DFFT benchmark specifies a symmetric two dimensional fast fourier transform (FFT) within a real-time software test bench. The test bench provides the realistic stimulus for the RT-2DFFT benchmark, including input output from/to onboard buffers. We developed a single RT-2DFFT implementation, heavily dependent on available library functions from MasPar, that can examine both benchmark latency specifications: latency equal to the period and latency greater than the period. Through the use of the Maspar RT-2DFFT benchmark implementation, we show that the MasPar MPPs can read two-dimensional data set or input array from an i/o buffer, perform the two dimensional FFT, and write the processed array out to an I/O buffer--all within the one second input array inter-arrival period specified in the benchmark. If latency is permitted to extend beyond one second, we show that it may be possible to reduce the machine size by processing sufficient multiple FFTs simultaneously, so that an entire row of a two-dimensional input array is assigned to a single processor. In this instance, the RT-2DFFT benchmark runs more efficiently, because communications overhead is minimized during both i/o and FFT processing.

DTIC

*Massively Parallel Processors; Software Engineering; Fast Fourier Transformations*

**19970019591** Tulane Univ., Dept. of Mathematics, New Orleans, LA USA

**Mathematical Foundations of Programming Semantics and Concurrency Workshop Final Report, 1 Mar. - 30 Sep. 1996**

Mislove, Michael, Tulane Univ., USA; Nov. 1996; 15p; In English

Contract(s)/Grant(s): N00014-96-I-0709

Report No.(s): AD-A318846; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Funds under this grant were used to support three principal activities. The first was the Twelfth Workshop on the Mathematical Foundations of Programming Semantics, which took place on the campus of the University of Colorado, Boulder from June 3 to June 5, 1996. The second was a series of visits by researchers to Tulane University during the two-month period June - July, 1996, to collaborate with the Principal Investigator on topics of common research interest. These visits formed the bulk of the Workshop on Concurrency listed in the title of the grant. Lastly, funds were used to help support participants in a small workshop in New Orleans from September 15 to September 17, 1996 which focused on applications of semantic techniques to problems in security of distributed computing systems.

DTIC

*Mathematical Programming; Programming Languages; Concurrent Engineering; Semantics*

**19970019605** Mei Technology Corp., San Antonio, TX USA

**COACH: A Sample Training Application for the Integrated Maintenance Information System (IMIS) Interim Report, Jul.**



**1992 - Aug. 1994**

Wilson, Andrew S., Mei Technology Corp., USA; Walsh, William J., Mei Technology Corp., USA; Feb. 1996; 121p; In English  
Contract(s)/Grant(s): F33615-91-D-0651; AF Proj. 1121

Report No.(s): AD-A316974; AL/HR-TR-1995-0203; No Copyright; Avail: CASI; A06, Hardcopy; A02, microfiche

This report summarizes activities conducted during early phases of a research project to evaluate use of the Integrated Maintenance Information System (IMIS) in aircraft maintenance training. Specifically, one IMIS component, the Portable Maintenance Aid (PMA), a job-aiding device used on the flightline, was studied to determine its potential application for training. Maintenance training embedded in the PMA can be useful if applied under the right conditions and circumstances, e.g., clearly distinguishing training from the real thing, and ensuring that simulated faults neither degrade weapon system performance nor personnel safety: In a formal school environment, IMIS provides the kind of diagnostic intelligence at-the-fingertip that can enable cognitive apprenticeship training to be effective. A demonstration program called COACH, a stand-alone application that can run on a PC or the PMA, was developed to illustrate how a training application could be implemented almost immediately on the PMA. Included in the appendix are sample screens that form a model for further development of an IMIS embedded training capability. Furthermore, the report describes how any training must interface with IMIS screens to make use of the inherent maintenance knowledge contained in IMIS.

DTIC

*Aircraft Maintenance; Information Systems; Maintenance Training; Safety*

**19970019622** Hydrologic Engineering Center, Davis, CA USA

**UNET: One-Dimensional Unsteady Flow Through a Full Network of Open Channels: User's Manual**

Barkau, Robert L., Hydrologic Engineering Center, USA; Jul. 1996; 288p; In English

Report No.(s): AD-A315684; HEC-CPD-66; No Copyright; Avail: CASI; A13, Hardcopy; A03, microfiche

UNET is a numerical model that simulates one dimensional unsteady flow through a full network of open channels. In addition to solving the network system, UNET provides the user with the ability to apply many external and internal boundary conditions, including: flow and stage hydrographs, rating curves, gated and uncontrolled spillways, pump stations, bridges, culverts, and levee systems.

DTIC

*User Manuals (Computer Programs); One Dimensional Flow; Unsteady Flow; Waterways*

**19970019637** Research Inst. for Advanced Computer Science, Moffett Field, CA USA

**An Efficient Multiblock Method for Aerodynamic Analysis and Design on Distributed Memory Systems**

Reuther, James, Research Inst. for Advanced Computer Science, USA; Alonso, Juan Jose, Stanford Univ., USA; Vassberg, John C., Douglas Aircraft Co., Inc., USA; Jameson, Antony, Stanford Univ., USA; Martinelli, Luigi, Princeton Univ., USA; Jan. 1997; 34p; In English; 13th; Computational Fluid Dynamics, Jun. 1997; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS2-96027; N00014-92-J-1796; F49620-95-I-0259

Report No.(s): NASA-CR-204485; NAS 1.26:204485; RIACS-TR-97-05; AIAA Paper 97-1893; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The work presented in this paper describes the application of a multiblock gridding strategy to the solution of aerodynamic design optimization problems involving complex configurations. The design process is parallelized using the MPI (Message Passing Interface) Standard such that it can be efficiently run on a variety of distributed memory systems ranging from traditional parallel computers to networks of workstations. Substantial improvements to the parallel performance of the baseline method are presented, with particular attention to their impact on the scalability of the program as a function of the mesh size. Drag minimization calculations at a fixed coefficient of lift are presented for a business jet configuration that includes the wing, body, pylon, aft-mounted nacelle, and vertical and horizontal tails. An aerodynamic design optimization is performed with both the Euler and Reynolds Averaged Navier-Stokes (RANS) equations governing the flow solution and the results are compared. These sample calculations establish the feasibility of efficient aerodynamic optimization of complete aircraft configurations using the RANS equations as the flow model. There still exists, however, the need for detailed studies of the importance of a true viscous adjoint method which holds the promise of tackling the minimization of not only the wave and induced components of drag, but also the viscous drag.

Author

*Navier-Stokes Equation; Parallel Computers; Aircraft Configurations; Transonic Flow; Distributed Processing; Computational Grids; Computational Fluid Dynamics; Aerodynamic Drag*



**19970019691** Georgia Inst. of Tech., Digital Signal Processing Lab., Atlanta, GA USA

**Conditional Entropy-Constrained Residual VQ with Application to Image Coding**

Kossentini, Faouzi, Georgia Inst. of Tech., USA; Chung, Wilson C., Georgia Inst. of Tech., USA; Smith, Mark J. T., Georgia Inst. of Tech., USA; IEEE Transactions on Image Processing; Feb. 1996; ISSN 1057-7149; Volume 5, No. 2, pp. 1-9; In English  
Contract(s)/Grant(s): NSF MIP-91-16113

Report No.(s): NASA-CR-204396; NAS 1.26:204396; Copyright Waived (NASA); Avail: CASI; A02, Hardcopy; A01, microfiche

This paper introduces an extension of entropy-constrained residual vector quantization (VQ) where intervector dependencies are exploited. The method, which we call conditional entropy-constrained residual VQ, employs a high-order entropy conditioning strategy that captures local information in the neighboring vectors. When applied to coding images, the proposed method is shown to achieve better rate-distortion performance than that of entropy-constrained residual vector quantization with less computational complexity and lower memory requirements. Moreover, it can be designed to support progressive transmission in a natural way. It is also shown to outperform some of the best predictive and finite-state VQ techniques reported in the literature. This is due partly to the joint optimization between the residual vector quantizer and a high-order conditional entropy coder as well as the efficiency of the multistage residual VQ structure and the dynamic nature of the prediction.

Author

*Vector Quantization; Coding; Prediction Analysis Techniques; Entropy*

**19970019693** Virginia Polytechnic Inst. and State Univ., Industrial and Systems Engineering, Blacksburg, VA USA

**Generalized Hill Climbing Algorithms For Discrete Optimization Problems**

Johnson, Alan W., Virginia Polytechnic Inst. and State Univ., USA; Jan. 09, 1997; 131p; In English

Report No.(s): AD-A319840; AFIT-96-45D; No Copyright; Avail: CASI; A07, Hardcopy; A02, microfiche

Generalized hill climbing (GHC) algorithms are introduced, as a tool to address difficult discrete optimization problems. Particular formulations of GHC algorithms include simulated annealing (SA), local search, and threshold accepting (TA), among others. A proof of convergence of GHC algorithms is presented, that relaxes the sufficient conditions for the most general proof of convergence for stochastic search algorithms in the literature (Anily and Federgruen (1987)). Proofs of convergence for SA are based on the concept that deteriorating (hill climbing) transitions between neighboring solutions are accepted by comparing a deterministic function of both the solution change cost and a temperature parameter to a uniform (0,1) random variable. GHC algorithms represent a more general model, whereby deteriorating moves are accepted according to a general random variable. Computational results are reported that illustrate relationships that exist between the GHC algorithm's finite-time performance on three problems, and the general random variable formulations used. The dissertation concludes with suggestions for further research.

DTIC

*Problem Solving; Stochastic Processes; Simulated Annealing; Algorithms; Convergence*

**19970019704** Georgia Inst. of Tech., School of Electrical & Computer Engineering, Atlanta, GA USA

**Subband Image Coding with Jointly Optimized Quantizers**

Kossentini, Faouzi, Georgia Inst. of Tech., USA; Chung, Wilson C., Georgia Inst. of Tech., USA; Smith Mark J. T., Georgia Inst. of Tech., USA; May 1995; 4p; In English

Contract(s)/Grant(s): NAG5-2187; NSF MIP-91-16113

Report No.(s): NASA-CR-204400; NAS 1.26:204400; No Copyright; Avail: CASI; A01, Hardcopy; A01, microfiche

An iterative design algorithm for the joint design of complexity- and entropy-constrained subband quantizers and associated entropy coders is proposed. Unlike conventional subband design algorithms, the proposed algorithm does not require the use of various bit allocation algorithms. Multistage residual quantizers are employed here because they provide greater control of the complexity-performance tradeoffs, and also because they allow efficient and effective high-order statistical modeling. The resulting subband coder exploits statistical dependencies within subbands, across subbands, and across stages, mainly through complexity-constrained high-order entropy coding. Experimental results demonstrate that the complexity-rate-distortion performance of the new subband coder is exceptional.

Author

*Algorithms; Coding; Mathematical Models; Statistical Analysis; Iteration; Counters*

**19970019716** Kansas Univ. Center for Research, Inc., Telecommunications and Information Sciences Lab., Lawrence, KS USA

**Multiprocessor Implementation of a Real-Time CELP Algorithm Final Report, Apr. 1994 - Oct. 1995**

Prescott, Glenn, Kansas Univ. Center for Research, Inc., USA; Chakravarthula, Hari N., Kansas Univ. Center for Research, Inc.,

USA; Sivaprakasam, Sinivas, Kansas Univ. Center for Research, Inc., USA; Johnson, Timothy, Kansas Univ. Center for Research, Inc., USA; Nov. 1996; 91p; In English

Contract(s)/Grant(s): F30602-94-C-0104; AF Proj. 4519

Report No.(s): AD-A319761; RL-TR-96-174; No Copyright; Avail: CASI; A05, Hardcopy; A01, microfiche

The objective of this effort was to develop the methodology of transferring communication signal processing algorithms from a single processor (SUN Workstation) to multiple DSP processors TMS320C40s. The Code Excited Linear Prediction (CELP) voice compression algorithm was chosen for real time implementation of 3 processors. The algorithm operates at an output rate of 4800 bits per second with an input sampling rate of 8000 samples per second. Using efficient parallel processing algorithms (optimized to reduce the inter-processor communication time overhead) one can implement complicated communication functions such as the CELP algorithm on more than one processor and achieve real time performance. A block diagram description of the CELP algorithm has been developed using the Signal Processing Worksystem (SPW), a block oriented design tool from the Alta Group of Cadence to generate optimized code for a VMEbus based network of TM5320C40 processors. The CELP algorithm is based on the U.S. Federal Standard 1016. Data transfers between the processors is achieved by using the C40 processors' high speed communication ports and concurrent multi channel DMA transfer capability. The approach frees the CPU of burdensome interprocessor communication functions.

DTIC

*Multiprocessing (Computers); Real Time Operation; Algorithms; Linear Prediction; Voice Communication*

**19970019940** Toledo Univ., Dept. of Electrical Engineering, OH USA

**Investigation of the Use of Erasures in a Concatenated Coding Scheme, Sep. 1994 - Jun. 1997**

Kwatra, S. C., Toledo Univ., USA; Marriott, Philip J., Toledo Univ., USA; Jun. 1997; 228p; In English

Contract(s)/Grant(s): NAG3-1718

Report No.(s): NASA-CR-204443; Rept-DTVI-53; NAS 1.26:204443; No Copyright; Avail: CASI; A11, Hardcopy; A03, microfiche

A new method for declaring erasures in a concatenated coding scheme is investigated. This method is used with the rate  $1/2$   $K = 7$  convolutional code and the (255, 223) Reed Solomon code. Errors and erasures Reed Solomon decoding is used. The erasure method proposed uses a soft output Viterbi algorithm and information provided by decoded Reed Solomon codewords in a deinterleaving frame. The results show that a gain of 0.3 dB is possible using a minimum amount of decoding trials.

Author

*Concatenated Codes; Reed-Solomon Codes; Decoding; Viterbi Decoders*

**19970020185** Oregon Graduate Inst. of Science and Technology, Portland, OR USA

**Microlanguage-Based Specialization, Oct. - Dec. 1996**

Pu, Calton, Oregon Graduate Inst. of Science and Technology, USA; Dec. 1996; 18p; In English

Contract(s)/Grant(s): F19528-95-C-0193; ARPA ORDER-D007

Report No.(s): AD-A320299; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Summarized is progress made during the period July through September 1996 for the DARPA contract 'Microlanguage-Based Specialization', part of the Synthetix Project. The main objective of the project is to design and implement microlanguages to support directed specialization of operating system kernels, to complement the inferred specialization in the Synthetix project. The key idea is to design a microlanguage tailored for each specific area that captures deep application semantics through a simple syntax. Significant progress is being made in the construction of the Synthetix specialization toolkit and the design of the first family of microlanguages for distributed multimedia support. this document also reports on the progress made in the context of the entire Synthetix project.

DTIC

*Systems Engineering; Programming Languages*

**19970020191** Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA

**Model Checking Algorithms for the mu-Calculus**

Berezin, Sergey, Carnegie-Mellon Univ., USA; Clarke, Edmund, Carnegie-Mellon Univ., USA; Jha, Somesh, Carnegie-Mellon Univ., USA; Marrero, Will, Carnegie-Mellon Univ., USA; Sep. 23, 1996; 28p; In English

Contract(s)/Grant(s): F33615-93-1-1330

Report No.(s): AD-A317576; CMU-CS-96-180; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The propositional mu-calculus is a powerful language for expressing properties of transition systems by using least and greatest fixpoint operators. Recently, the mu-calculus has generated much interest among researchers in computer-aided verification.

This interest stems from the fact that many temporal and program logics can be encoded into the mu-calculus. In addition, important relations between transition systems, such as weak and strong bisimulation equivalence, also have fixpoint characterizations. Wide-spread use of binary decision diagrams has made fixpoint based algorithms even more important, since methods that require the manipulation of individual states do not take advantage of this representation.

DTIC

*Computer Techniques; Algorithms; Programming Languages*

**19970020213** Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA

**Tracking the Effectiveness of Usability Evaluation Methods**

John, Bonnie E., Carnegie-Mellon Univ., USA; Marks, Steven J., Standard Microsystems, USA; Aug. 12, 1996; 24p; In English  
Contract(s)/Grant(s): N00014-93-1-0934

Report No.(s): AD-A317580; CMU-HCII-96-102; CMU-CS-96-160; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

We present a case study that tracks usability problems predicted with six usability evaluation methods (Claims Analysis, Cognitive Walkthrough, GOMS, Heuristic Evaluation, User Action Notation, and simply reading the specification) through a development process. We assess the methods predictive power by comparing the predictions to the results of user tests. We assess the methods persuasive power by seeing how many problems led to changes in the implemented code. We assess design-change effectiveness by user testing the resulting new versions of the system. We conclude that predictive methods are not as effective as the HCI field would like and discuss directions for future research.

DTIC

*Effectiveness; Evaluation; Computer Programs; Computer Aided Design*

**19970020219** Oregon Graduate Inst. of Science and Technology, Dept. of Computer Science and Technology, Beaverton, OR USA

**Specialization Classes: An Object Framework for Specialization**

Cowan, Crispin, Oregon Graduate Inst. of Science and Technology, USA; Black, Andrew, Oregon Graduate Inst. of Science and Technology, USA; Krasic, Charles, Oregon Graduate Inst. of Science and Technology, USA; Consel, Charles, Rennes Univ., France; Volanschi, Eugen-Nicolae, Rennes Univ., France; Sep. 06, 1996; 6p; In English

Contract(s)/Grant(s): N00014-94-I-0845; F19628-95-C-0193; NSF CCR-92-24375

Report No.(s): AD-A316782; No Copyright; Avail: CASI; A02, Hardcopy; A01, microfiche

This paper presents an object-oriented framework for specifying specializations in long-running programs such as operating systems. This model is based on the following concepts: (1) Inheritance allows replacement implementations of member functions. We thus use a graph of sub-classes to specify a set of potential specializations of a given facility by replacing generic implementations with specialized implementations; (2) Specializations in long-running programs are temporary, because the particular circumstances that permit the use of a specialized implementation are likely to change eventually. We thus support temporary and even optimistic specializations; and (3) Ensuring that it is valid to use a specialized implementation can be more difficult than creating the specialized implementation. We thus use a formal method to specify when a specialization is valid. This lets us automatically detect when specialization circumstances have changed, and also automatically generate specialized implementations using partial evaluation.

DTIC

*Object-Oriented Programming; Data Management; Operating Systems (Computers)*

**19970020284** Maryland Univ., College Park, MD USA

**Site Model Based Image Registration and Change Detection, Sep. 1993 - Sep 1994**

Chellappa, R., Maryland Univ., USA; Burlina, P., Maryland Univ., USA; Rosenfeld, A., Maryland Univ., USA; Lin, C. L., Maryland Univ., USA; Zhang, X., Maryland Univ., USA; Nov. 1996; 49p; In English

Contract(s)/Grant(s): DACA76-92-C-0024

Report No.(s): AD-A317397; TEC-0090; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), microfiche

The University of Maryland is one of the BAA contractors performing research on aerial image understanding for the RADIUS project. We are contributing model-based and context-based change detection (CD) and monitoring algorithms. Our principal points of focus during the reporting period have been: (a) monitoring movable objects (detection and counting of vehicles), (b) monitoring construction activities for modeled objects, and (c) developing automated image positioning schemes. We exploit

geometric and context information derived from site models to accomplish these monitoring tasks. We also have placed special emphasis on the integration of our modules within the RADIUS Common Development Environment (RCDE) platform.

DTIC

*Image Processing; Computer Vision; Change Detection; Aerial Photography; Pattern Registration*

**19970020287** San Diego Supercomputer Center, San Diego, CA USA

**Massive Data Analysis Systems Quarterly Report, Jun. - Aug. 1996**

Frost, Richard, San Diego Supercomputer Center, USA; Wan, Mike, San Diego Supercomputer Center, USA; Baru, Chaitanya, San Diego Supercomputer Center, USA; Moore, Reagan, San Diego Supercomputer Center, USA; Marciano, Richard, San Diego Supercomputer Center, USA; Gottemukkala, Vibby, IBM Watson Research Center, USA; Jhingran, Arnant, IBM Watson Research Center, USA; Oct. 07, 1995; 50p; In English

Contract(s)/Grant(s): F19628-95-C-0194; ARPA Order D007; ARPA Order D309

Report No.(s): AD-A316883; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The creation of a Massive Data Analysis System (MDAS) will enable new modes of science through improved data management of scientific data sets. This requires a scalable software infrastructure that can manage petabytes of data, support rapid access of selected data sets, and provide support for subsequent computationally intensive analyses. To accomplish this, object-relational database technology is being integrated with archival storage systems. By supporting transportable methods for manipulating the data, it then becomes possible to analyze selected data sets on remote systems. The MDAS becomes a scheduling system, managing the flow of data and computation across distributed resources. Usage models are needed that simplify the identification, transport and analysis of large collections of data. The system must automate the collection of metadata describing the data set attributes, and handle interactive WEB access, distributed database access, and discipline specific application interfaces. A software infrastructure has been designed which manages user access restrictions, matches application requirements with resource availability, and schedules the data movement and application execution. Development of this software system is proceeding on schedule, with selected applications testing the initial prototypes.

DTIC

*Data Management; Relational Data Bases; Computer Programs*

**19970020339** Carnegie-Mellon Univ., School of Computer Science, Pittsburgh, PA USA

**A Trace-Driven Comparison of Algorithms for Multi-Process Prefetching and Caching**

Tomkins, Andrew, Carnegie-Mellon Univ., USA; Patterson, R. H., Carnegie-Mellon Univ., USA; Gibson, Garth, Carnegie-Mellon Univ., USA; Sep. 1996; 25p; In English

Contract(s)/Grant(s): DABT63-93-C-0054; NSF ECD-89-07068

Report No.(s): AD-A317570; CMU-CS-96-174; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Recently two groups of researchers have proposed systems that exploit application knowledge to improve I/O performance. Both systems use application knowledge to prefetch data thereby masking I/O latency and to improve file buffer cache performance thereby avoiding slow I/O accesses altogether. Unfortunately, published studies of these two systems are incomparable. In this technical report we consider multiple processes, each of which has either full advance knowledge (complete hints) or no advance knowledge (no hints). Our results can be summarized as follows: the cost-benefit analysis of TIP2 allows better performance when optimal buffer allocation does not correspond to process consumption rates.

DTIC

*Distributed Processing; Input/Output Routines; Algorithms*

**19970020401** Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia

**Virtual Reality Technologies and Systems**

Sestito, Sabrina, Defence Science and Technology Organisation, Australia; Mar. 1997; 71p; In English; Original contains color illustrations

Report No.(s): DSTO-TR-0501; AR-010-150; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, microfiche

The aim of this report is to provide an overview of recent developments in some key Virtual Reality (VR) technologies and systems. Various definitions of VR will be provided. Current VR hardware (Head Mounted Displays, BOOM devices, Stereo Glasses, Convolvotron, Gloves, Tracking devices) and VR software (computer graphic issues, object representation and toolkits) will be discussed. Current innovative systems will then be presented which will include a discussion of SmartScene, PolyShop,



Responsive Workbench, Virtual Workbench and the CAVE. Finally, a brief discussion of applications and areas of research will be presented.

Author

*Virtual Reality; Computer Systems Programs; Hardware*

**19970020409** Rohr Applied Systems Corp., Sterling, VA USA

**Modifying the Computerized Testing System Final Report, Jun. - Oct. 1994**

Rohr, Jay J., Rohr Applied Systems Corp., USA; Oct. 1996; 4p; In English

Contract(s)/Grant(s): DASW01-94-M-8671

Report No.(s): AD-A317471; ARI-CR-97-03; No Copyright; Avail: CASI; A01, Hardcopy; A01, microfiche

The following changes were made to the existing Computerized Testing System: (a) Modified to use a computer mouse and joystick input devices. The calibration procedures and instruction screens were modified to function correctly with these new devices. (b) The One-Hand Tracking test was added to the battery (c) Program modified to recycle to a new examined at the conclusion of testing. Changes to the source code were documented.

DTIC

*Computerized Simulation; Software Reliability; Calibrating*

**19970020410** Physics and Electronics Lab. TNO, The Hague, Netherlands

**Conjugate Gradient Schemes for Motion Estimation in Image Sequences**

Berkhoff, A. P., Physics and Electronics Lab. TNO, Netherlands; Feb. 1997; 27p; In English

Report No.(s): FEL-96-B265; TD97-0074; Copyright; Avail: Issuing Activity (TNO Physics and Electronics Lab., PO Box 96864, 2509 JG The Hague, The Netherlands), Hardcopy, microfiche

This report describes methods for the estimation of local motion in a sequence of images. The methods are based on a global minimization of a relevant error criterion using a conjugate gradient technique. The expansion of the displacement field is carried out with the use of basis functions according to a Fourier transform or a cosine/sine transform in space and time. These representations automatically result in a continuous displacement field where subpixel displacements can be detected. The error criterion can be based on a displacement vector for each pixel, but also on linearized versions in vectorial and scalar form, depending on the desired trade-off between computation time and accuracy.

Author

*Conjugate Gradient Method; Sequencing; Image Processing; Signal Processing*

**19970020436** Onyx Sciences Corp., Cambridge, MA USA

**Scalable Processing for Distributed Simulation and Scene Generation, Apr. - Oct. 1994**

Rhodes, Brahm A., Onyx Sciences Corp., USA; Bronson, Steve D., Onyx Sciences Corp., USA; Jul. 1995; 45p; In English

Contract(s)/Grant(s): DACA76-94-C-0007

Report No.(s): AD-A317347; TEC-0065; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

This report details the results of researching and evaluating massively parallel architectures and visualization techniques. The main focus of this project was to evaluate and determine the potential of parallel computing systems for visual simulation applications, such as distributed interactive simulation, scene generation, visualization and others. This report summarizes results of our performance tests; describes scenarios and architectures that exploit parallel processors for visual simulation applications; discusses the state of the parallel computing industry; and presents recommendations for further research and development. Furthermore, this document describes a prototype toolkit to explore various options for using parallel processors for visual simulation.

DTIC

*Distributed Interactive Simulation; Massively Parallel Processors; Parallel Processing (Computers)*

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### COMPUTER SYSTEMS

*Includes computer networks and special application computer systems.*

**19970019315** Princeton Univ., Dept. of Chemistry, NJ USA

**Extraction of High Quality Potential Surfaces from Laboratory Data Final Report, 15 May 1993 - 31 May 1996**

Rabitz, Herschel, Princeton Univ., USA; Oct. 15, 1996; 13p; In English

Contract(s)/Grant(s): F49620-93-I-0300; AF Proj. 3484



Report No.(s): AD-A317239; AFOSR-TR-96-0510; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

This AASERT project has explored the capability of a new tracking-based algorithm for extracting high quality potential surfaces from time-dependent laboratory data. The algorithm is based on a special inversion technique for tracking the temporal data as a means to extract its underlying potential surface information. The basic concepts for the algorithm have now been developed and successfully tested in several simulations. An attractive feature of the algorithm is its parallel structure with quantum mechanical control techniques, thus ultimately opening up the prospect of combining control and inversion of molecular dynamics into a single cooperative laboratory-based venture.

DTIC

*Data Management; Molecular Structure; Computerized Simulation; Data Bases; Molecular Dynamics; Algorithms; Time Dependence; Quantum Theory*

**19970019494** Army Research Lab., Aberdeen Proving Ground, MD USA

**Optimizing the Performance of a Network File System** *Final Report, Sep. 1986 - Sep 1992*

Pressel, Daniel M., Army Research Lab., USA; Dec. 1996; 36p; In English; Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

Report No.(s): AD-A320624; ARL-SR-48; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), microfiche

This report summarizes conclusions drawn from work (primarily as a systems and network administrator) conducted by the author when he was still employed at the U.S. Army's Chemical Research, Development, and Engineering Center (CRDEC). It will discuss a number of considerations which can affect the performance of computer systems running a variant of Sun Microsystems's Network File System (NFS). Additionally, the potential for enhancements to the TCP/IP standard will also be raised. This report assumes that the reader already has some familiarity with NFS and, hopefully, some knowledge of networking using TCP/IP. It is hoped that this report will help other system and network administrators use NFS, while at the same time encouraging developers of NFS to come up with more robust implementations.

DTIC

*Computer Networks; Systems Engineering; Distributed Processing; Data Management*

**19970019508** Elizabeth City State Univ., NC USA

**Elizabeth City State University ONR-AASERT Summer 1996 Research Teams** *Quarterly Report*

Hayden, Linda, Elizabeth City State Univ., USA; Aug. 1996; 60p; In English; Limited Reproducibility: More than 20% of this document may be affected by microfiche quality

Contract(s)/Grant(s): N00014-94-I-1089; N00014-94-I-0948

Report No.(s): AD-A317684; AASERT-5-52562; AASERT-5-52561; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), microfiche

The AASERT Summer Research Program is part of a trio of programs at ECSU funded by ONR. They include the parent grant Nurturing ECSU Research Talent (NERT), NERT-I(Instrumentation) and Augmentation Award for Science and Engineering Research Training(AASERT). The AASERT grant provides funds for the summer component while NERT-I provides instrumentation for both NERT and AASERT. Student development activities have included the following: (1) Recruitment of high ability minority students; (2) Providing a summer program for recruited students; (3) Providing research experiences; (4) Providing a mentor, graduate school counseling and GRE preparation; (5) Providing financial support for students in the form of research assistantships; and (6) Providing funds for student travel. This report documents the summer research activities of the NERT and AASERT program.

DTIC

*University Program; Computer Networks; Research Management*

**19970019638** Research Inst. for Advanced Computer Science, Moffett Field, CA USA

**Efficient Load Balancing and Data Remapping for Adaptive Grid Calculations**

Oliker, Leonid, Research Inst. for Advanced Computer Science, USA; Biswas, Rupak, MRJ Technology Solutions, USA; Apr. 1997; 14p; In English; 9th; Parallel Algorithms and Architectures, 22-25 Jun. 1997, Newport, RI, USA; Sponsored by Association for Computing Machinery, USA

Contract(s)/Grant(s): NAS2-96027; NAS2-14303

Report No.(s): NASA-CR-204487; NAS 1.26:204487; RIACS-TR-97-03; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Mesh adaption is a powerful tool for efficient unstructured- grid computations but causes load imbalance among processors on a parallel machine. We present a novel method to dynamically balance the processor workloads with a global view. This paper presents, for the first time, the implementation and integration of all major components within our dynamic load balancing strategy for adaptive grid calculations. Mesh adaption, repartitioning, processor assignment, and remapping are critical components of the framework that must be accomplished rapidly and efficiently so as not to cause a significant overhead to the numerical simulation. Previous results indicated that mesh repartitioning and data remapping are potential bottlenecks for performing large-scale scientific calculations. We resolve these issues and demonstrate that our framework remains viable on a large number of processors.

Author

*Unstructured Grids (Mathematics); Parallel Processing (Computers); Multiprocessing (Computers); Dynamic Loads; Balancing*

**19970019948** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Pentran: A Parallel 3-D S Transport Code With Complete Phase Space Decomposition, Adaptive Differencing, and Iterative Solution Methods**

Sjoden, Glenn E., Air Force Inst. of Tech., USA; Jan. 09, 1997; 320p; In English

Report No.(s): AD-A320419; AFIT-96-49D; No Copyright; Avail: CASI; A14, Hardcopy; A03, microfiche

This thesis is based on the development and testing of the PENTRAN (Parallel Environment Neutral particle TRANsport) discrete ordinates code, designed for distributed memory and distributed computing parallel environments. The code can iteratively solve complex problems in nuclear design with complete, automatic decomposition of the angular, energy, and spatial variables. Written in ANSI FORTRAN-77 using the new standard Message Passing Interface library, PENTRAN is 28,500 lines and solves multigroup, anisotropic, three-dimensional discrete ordinates neutron and photon transport problems. Using a Block-Jacobi or Red-Black algorithm with automatic decomposition onto a distributed memory array of n processors, the code also has options to automatically load balance subdomain assignments. Memory in PENTRAN is partitioned so that each processor is only required to store the subdomain needed for local computation of the angular, energy, and spatial discretization, making the code scalable in memory by using more processors with increased decomposition. Further, as a direct result of this research, new numerical approaches that enhance the flexibility and accuracy of 3-D transport calculations have been developed and incorporated into PENTRAN. These include an adaptive differencing strategy that contains a new hybrid discrete ordinates differencing scheme, Exponential-Directional Weighted (EDW) differencing, a new discontinuous grid treatment with Taylor Projected Mesh Coupling (TPMC), and a simplified TPMC-multigrid acceleration. Tests show that PENTRAN has a 97% parallel code fraction, is scalable, and has been successfully benchmarked in parallel against conventional, single CPU production codes with appreciable speedups. With the completion of parallel code development, testing, and benchmarking, PENTRAN is now ready to be used to solve actual 3-D problems that are practical (or tractable) to solve on single CPU computers.

DTIC

*Computer Programs; Parallel Processing (Computers); Distributed Processing; Algorithms; Neutral Particles; Transport Properties; Neutrons; Photons; Finite Difference Theory; Iterative Solution*

**19970020091** Stanford Univ., Stanford, CA USA

**Training in Research and Construction of Secure Distributed Real-Time Systems Final Report**

Luckham, David C., Stanford Univ., USA; Oct. 1996; 5p; In English

Contract(s)/Grant(s): N00014-93-I-1216; N00014-92-J-1928; N00014-93-I-1335; AF-AFOSR-0354-91

Report No.(s): AD-A320352; No Copyright; Avail: CASI; A01, Hardcopy; A01, microfiche

We had proposed to augment current ARPA, and AFOSR funded research and technology projects by supporting additional graduate students, one from ARPA and one from AFOSR and their computing equipment. These students were trained on these DoD research projects in the areas of design and implementation of specification and prototyping languages for system architecture. The students were trained in (1) specification and prototyping of architectures for avionics systems, simulation systems, and other time-critical systems, (2) methods of testing actual products for conformance to architectural standards, and (3) design and implementation of support tools for simulation and verification of such systems.

DTIC

*Architecture (Computers); Avionics; Real Time Operation; Systems Simulation; Distributed Processing*

**19970020186** Logistics Management Inst., McLean, VA USA

**Aviation System Analysis Capability Quick Response System Report Server User's Guide Final Report**

Roberts, Eileen R., Logistics Management Inst., USA; Villani, James A., Logistics Management Inst., USA; Wingrove, Earl R., III, Logistics Management Inst., USA; Oct. 1996; 58p; In English

Contract(s)/Grant(s): NAS2-14361

Report No.(s): AD-A320305; LMI-NS601RD1; No Copyright; Avail: CASI; A04, Hardcopy; A01, microfiche

This report is a user's guide for the Aviation System Analysis Capability Quick Response System (ASAC QRS) Report Server. The ASAC QRS is an automated online capability to access selected ASAC models and data repositories. It supports analysis by the aviation community. This system was designed by the Logistics Management Institute for the NASA Ames Research Center. The ASAC QRS Report Server allows users to obtain information stored in the ASAC Data Repositories.

DTIC

*User Manuals (Computer Programs); Systems Analysis; Information Retrieval; Civil Aviation*

**19970020344** Strategic Air Command, Offutt AFB, NE USA

**A Target Selection Tool for Network Interdiction**

Whiteman, Philip S., Strategic Air Command, USA; Sep. 11, 1996; 17p; In English; 64th; MORS, USA

Report No.(s): AD-A317622; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

In an era of aggressive strategic force reductions it has become increasingly important to plan available weapons in the most effective manner possible. A Network Interdiction Tool has been developed with commercial and DoD software to utilize integer programming optimization techniques to determine an optimal interdiction strategy for systems which have a network architecture. Other analytical tools have been integrated with the optimization routine to provide quantitative comparisons of targeting strategies under varying assumptions and objectives. Due to inherent limitations of any model, it is paramount that the reasoning power of the expert operational planner (or 'strategist') be maintained 'in the loop.' This has been achieved by the development of a robust graphical user interface.

DTIC

*Integers; Graphical User Interface; Weapon System Management; Computer Networks; Conferences*

**19970020434** Institute for Human Factors TNO, Soesterberg, Netherlands

**Feasibility Study Teleworking in Field Situations Final Report Verkenning Telewerken te Velde**

Werkhoven, P. J., Institute for Human Factors TNO, Netherlands; Punte, P. A. J., Institute for Human Factors TNO, Netherlands; Wertheim, A. H., Institute for Human Factors TNO, Netherlands; Spoelma, E. R., Institute for Human Factors TNO, Netherlands; vanOrden, C. Y. D., Institute for Human Factors TNO, Netherlands; Apr. 09, 1997; 47p; In Dutch

Contract(s)/Grant(s): A95/KL/376

Report No.(s): TD97-0187; TM-97-A025; Copyright; Avail: Issuing Activity (TNO, Human Factors Research Inst., Kampweg 5, 3769 De Soesterberg, The Netherlands), Hardcopy, microfiche

By order of the Royal Netherlands Army, TNO HFRI has carried out a study to determine the feasibility of teleworking in a military context. We have studied which specific tasks are suitable for teleworking and which human factors aspects should be considered when introducing teleconferencing. Interviews have revealed that rendezvous meetings in the field could benefit from teleworking (teleconferencing) techniques. Other candidates are vertical consultancy meetings between staff members or specialists at different hierarchical levels but sharing professional knowledge. Teleworking can considerably reduce the time needed to physically get together (traveling time), especially for meetings in The Hague. During field exercises instructors could 'look through the eye' of a vehicle crew from a distance using teleconferencing techniques and even point on electronically shared maps. Important conditions for the introduction of teleconferencing are usability, psychological acceptance, easy to learn, operability, solidness during exercises, training and wartime, assurance of confidentiality and clear benefits. Several organizational and cultural aspects are discussed that may hamper the introduction of teleworking. Human factors issues of teleworking that deserve special attention are socio-psychological impact, perceptual quality of the audio/visual media used for teleconferencing and the configuration of displays and speakers (isotropic communication spaces). For a successful and effective introduction of teleconferencing techniques in the selected application areas we suggest to carry out a pilot-experiment, initially based on commercial off-the-shelf systems. The set-up of the pilot-experiment should be such that the possible bottle-necks described in this report could be evaluated in specific practice situations with respect to functionality, quality of information transfer, task performance and acceptance.

Author

*Feasibility; Teleconferencing; Netherlands; Information Transfer; Human Performance*

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**CYBERNETICS**

*Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also 54 Man/ System Technology and Life Support.*

**19970019895** Maryland Univ., Center for Automation Research, College Park, MD USA

**Multi-Scale Discriminant Analysis and Recognition of Signals and Images**

Etemad, Kamran, Maryland Univ., USA; May 1996; 131p; In English

Contract(s)/Grant(s): N00014-95-I-0521; ARPA Order-C635

Report No.(s): AD-A319296; CAR-TR-821; CS-TR-3629; No Copyright; Avail: CASI; A07, Hardcopy; A02, microfiche

This dissertation explores multiscale discriminant basis selection, as well as the improvement of classification reliability through context-dependent integration of soft decisions. These methods are applied to texture and radar signature classification, document image segmentation, and human face recognition.

DTIC

*Discriminant Analysis (Statistics); Image Classification; Imaging Techniques*

**19970020039** Department of the Navy, Washington, DC USA

**Hybrid Neural Network for Pattern Recognition**

Nguyen, Chung T., Inventor, Department of the Navy, USA; Feb. 03, 1997; 17p; In English

Patent Info.: Filed 3 Feb. 1997; US-Patent-Appl-SN-802572

Report No.(s): AD-D018425; No Copyright; Avail: Issuing Activity (Dept. of the Navy, Washington DC), microfiche

A system for recognizing patterns comprises a first stage for extracting features from inputted patterns and for providing topological representations of the characteristics of the inputted patterns and a second stage for classifying and recognizing the inputted patterns. The first stage comprises two one-layer neural networks and the second stage comprises a feedforward two-layer neural network. A method for recognizing patterns is also described, which method broadly comprises the steps of providing first and second neural networks, each having an input layer formed by a plurality of input neurons and an output layer formed by a plurality of output neurons, supplying signals representative of a set of inputted patterns to the input layers of the first and second neural networks, training the first and second neural networks using a competitive learning algorithm, and generating topological representations of the input patterns using the first and second neural networks. The method further comprises providing a third neural network for classifying and recognizing the inputted patterns and training the third neural network with a back-propagation algorithm so that the third neural network recognizes at least one interested pattern.

DTIC

*Neural Nets; Pattern Recognition*

**19970020110** Naval Postgraduate School, Dept. of Computer Science, Monterey, CA USA

**Implementing Voice Recognition and Natural Language Processing in the NPSNET Networked Virtual Environment**

DeVilliers, Edward Michael, Naval Postgraduate School, USA; Sep. 1996; 193p; In English

Report No.(s): AD-A320340; No Copyright; Avail: CASI; A09, Hardcopy; A03, microfiche

Interfaces to military Virtual Reality (VR) systems, such as NPSNET IV.9, have been limited mainly to keyboard, mouse, and joystick devices. This presents two major problems; remembering how to access all the functionality of the system, and using the interface when the user is otherwise physically constrained. This can occur during the use of body-position tracking devices and Heads-Up-Displays (HUD). Voice recognition and Natural Language Processing (NLP) were used as a solution to both problems. The approach taken was to develop a networked Spoken Language System (SLS) using a Commercial-Off-The-Shelf (COTS) voice recognition and NLP system. The Nuance Speech Recognition System from Nuance Communications was chosen after analyzing the special requirements of NPSNET. Implementing the SLS occurred in four phases. First, vocabularies and grammars were developed to simulate the 108 keyboard commands, focusing on flexibility and decreased response latency. Second, new C++ classes were written to ease reuse of the Nuance API's. Third, a control panel was written to manage the voice processing, and fourth, the code was integrated into NPSNET. As a result of this effort, a new voice-enabled interface exists for NPSNET. In addition, C++ classes exist to ease future use of the Nuance API in other software systems. All of the 108 keyboard commands are executable through voice control with a 83.8% sentence understanding rate in a noisy background environment.

DTIC

*Speech Recognition; Virtual Reality; Natural Language Processing; Software Engineering; Human-Computer Interface*



**19970020179** Pennsylvania State Univ., Center for Multivariate Analysis, University Park, PA USA

**A New LVQ Model**

Bose, S., Pennsylvania State Univ., USA; Murthy, C. A., Pennsylvania State Univ., USA; Aug. 1996; 48p; In English  
Contract(s)/Grant(s): DAAH04-96-1-0082

Report No.(s): AD-A317014; ARO-30529.91-MA-SDI; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

A new LVQ model has been proposed here. An exponential membership function has been considered in this regard. The performance of the new model in relation to other existing models has been studied experimentally with the help of an artificial data set as well as IRIS data. Finally the proposed algorithm is applied on a satellite image data. The proposed model has been found to provide satisfactory results with all these data sets.

DTIC

*Mathematical Models; Neural Nets; Image Processing; Fuzzy Sets; Systems Analysis; Satellite Imagery; Algorithms*

**19970020184** Texas A&M Univ., Dept. of Aerospace Engineering, College Station, TX USA

**Mechanics and Control of Nonlinear Structures Annual Report, 31 Aug. 1993 - 31 Jul. 1996**

Junkins, John L., Texas A&M Univ., USA; Nov. 22, 1996; 337p; In English

Contract(s)/Grant(s): F49620-92-J-0496; AF Proj. 2306

Report No.(s): AD-A320235; AFOSR-TR-97-0035; No Copyright; Avail: CASI; A15, Hardcopy; A03, microfiche

This report documents results of analytical, computational, and experimental research on nonlinear structural analysis. In particular, a novel inverse dynamics method is presented whereby exact solutions for nonlinear dynamical response can be determined near a given approximate numerical solution. This method is useful for validation and tuning of dynamic response simulations. Also, novel results are reported for parameterization of NxN proper orthogonal matrices and applications in mechanics and control are explored. A novel quasi-coordinate method is developed for nonlinear flexible multi-body structural systems having a configuration variable mass matrix. This approach avoids the necessity of inverting the mass matrix through the derivation of differential equations which generate an instantaneously diagonalizing transformation. Finally, experimental results of maneuvers of the ASTREX Test Article are presented.

DTIC

*Structural Analysis; Dynamic Response; Nonlinear Systems; Vibration; Control Theory*

**19970020195** Maryland Univ., Computer Vision Lab., College Park, MD USA

**Algorithm-Independent Stability Analysis of Structure from Motion**

Fermueller, Cornelia, Maryland Univ., USA; Aloimonos, Yiannis, Maryland Univ., USA; Sep. 1996; 39p; In English

Contract(s)/Grant(s): N00014-96-I-0587

Report No.(s): AD-A316773; CAR-TR-840; CS-TR-3691; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The stability analysis for the structure from motion problem presented in this paper investigates the optimal relationship between the errors in the estimated translational and rotational parameters of a rigid motion that results in the estimation of a minimum number of negative depth values. No particular estimators are used and no specific assumptions about the scene are made. The input used is the value of the flow along some direction, which is more general than optic flow or correspondence. For a planar retina it is shown that the optimal configuration is achieved when the projections of the translational and rotational errors on the image plane are perpendicular. For a spherical retina, given a rotational error, the optimal translation is the correct one, while given a translational error the optimal rotational error is normal to the translational one at an equal distance from the real and estimated translations. The proofs, besides illuminating the confounding of translation and rotation in structure from motion, have an important application to ecological optics. The same analysis provides a computational explanation of why it is much easier to estimate self-motion in the case of a spherical retina and why it is much easier to estimate shape in the case of a planar retina, thus suggesting that nature's design of compound eyes (or panoramic vision) for flying systems and camera-type eyes for primates (and other systems that perform manipulation) is optimal.

DTIC

*Image Processing; Computer Vision; Image Analysis; Retina*

**19970020204** NASA Lewis Research Center, Cleveland, OH USA

**A New Technique for Compensating Joint Limits in a Robot Manipulator**

Litt, Jonathan, Army Research Lab., USA; Hickman, Andre, Morehouse Coll., USA; Guo, Ten-Huei, NASA Lewis Research Center, USA; Oct. 1996; 26p; In English

Contract(s)/Grant(s): RTOP 505-62-50; DA Proj. 1L1-61102-AH-45

Report No.(s): NASA-TM-107330; NASA-E-10451; NAS 1.15:107330; AD-A316960; ARL-TR-1101; No Copyright; Avail:



CASI; A03, Hardcopy; A01, microfiche

A new robust, optimal, adaptive technique for compensating rate and position limits in the joints of a six degree-of-freedom elbow manipulator is presented. In this new algorithm, the unmet demand as a result of actuator saturation is redistributed among the remaining unsaturated joints. The scheme is used to compensate for inadequate path planning, problems such as joint limiting, joint freezing, or even obstacle avoidance, where a desired position and orientation are not attainable due to an unrealizable joint command. Once a joint encounters a limit, supplemental commands are sent to other joints to best track, according to a selected criterion, the desired trajectory.

DTIC

*Algorithms; Manipulators; Robotics; End Effectors; Adaptive Control; Optimal Control*

## 64

### NUMERICAL ANALYSIS

*Includes iteration, difference equations, and numerical approximation.*

**19970019584** Minnesota Univ., Dept. of Computer Science, Minneapolis, MN USA

#### **Numerical Solution of Nonlinear Oscillatory Multibody Dynamic Systems**

Yen, Jeng, Minnesota Univ., USA; Petzold, Linda R., Minnesota Univ., USA; Sep. 18, 1996; 18p; In English  
Contract(s)/Grant(s): DAAL03-92-G-0247; DAAH04-95-C-0003; DAAH04-95-C-0008; DAAH04-94-G-0208

Report No.(s): AD-A316993; TR-95-066; ARO-29850.3-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

One of the outstanding problems in the numerical simulation of mechanical systems is the development of efficient methods for dealing with highly oscillatory systems. These types of systems arise for example in vehicle simulation in modeling the suspension system or tires, in models for contact and impact, in flexible body simulation from vibrations in the structural model, and in molecular dynamics. Simulations involving high frequency vibration can take a huge number of time steps, often as a consequence of oscillations which are not physically important. The components causing the oscillations cannot usually be eliminated from the model because in some situations they are critical to the simulation. The equations of motion of a multibody mechanical system are described by a system of differential-algebraic equations (DAEs). In this paper, we will explore two types of methods. The first class of methods damps out the oscillation via highly stable implicit methods. Even in this relatively simple approach, unforeseen problems may arise for Newton iteration convergence, due to the nonlinearities. The second class of methods involves linearizing the system around the smooth solution. The linearized system can be solved rapidly via a number of different methods.

DTIC

*Molecular Dynamics; Vibration; Convergence; Equations of Motion*

**19970019644** NASA Lewis Research Center, Cleveland, OH USA

#### **Finite Difference Time Marching in the Frequency Domain: A Parabolic Formulation for the Convective Wave Equation**

Baumeister, K. J., NASA Lewis Research Center, USA; Kreider, K. L., Akron Univ., USA; Transactions of the ASME; Oct. 1996; Volume 118, pp. 622-629; In English

Report No.(s): NASA-CR-204553; NAS 1.26:204553; No Copyright; Avail: CASI; A02, Hardcopy; A01, microfiche

An explicit finite difference iteration scheme is developed to study harmonic sound propagation in ducts. to reduce storage requirements for large 3D problems, the time dependent potential form of the acoustic wave equation is used. to insure that the finite difference scheme is both explicit and stable, time is introduced into the Fourier transformed (steady-state) acoustic potential field as a parameter. Under a suitable transformation, the time dependent governing equation in frequency space is simplified to yield a parabolic partial differential equation, which is then marched through time to attain the steady-state solution. The input to the system is the amplitude of an incident harmonic sound source entering a quiescent duct at the input boundary, with standard impedance boundary conditions on the duct walls and duct exit. The introduction of the time parameter eliminates the large matrix storage requirements normally associated with frequency domain solutions, and time marching attains the steady-state quickly enough to make the method favorable when compared to frequency domain methods. For validation, this transient-frequency domain method is applied to sound propagation in a 2D hard wall duct with plug flow.

Author

*Finite Difference Theory; Partial Differential Equations; Wave Equations; Sound Propagation; Ducts; Acoustics; Time Dependence*

**19970019741** Maryland Univ., Inst. for Physical Science and Technology, and Dept. of Mathematics, College Park, MD USA

**AASERT92 - Variational Principles and Stability in Hamiltonian Final Report, 1 Jun. 1993 - 31 May 1996**

Maddocks, John H., Maryland Univ., USA; May 1996; 3p; In English

Contract(s)/Grant(s): F49620-93-I-0323; AF Proj. 3484

Report No.(s): AD-A317238; AFOSR-TR-96-0509; No Copyright; Avail: CASI; A01, Hardcopy; A01, microfiche

This report describes research carried out by students under the above detailed AASERT award. The grant has been used to support two graduate students and two undergraduates (all American citizens as required by the term of the award.)

DTIC

*Hamiltonian Functions; Variational Principles*

**19970019932** Naval Air Warfare Center, Aircraft Div., Warminster, PA USA

**Wedge Theory/Compound Matrices: Properties and Applications Final Report, Jun. 1995 - Aug. 1996**

Boutin, Debra L., Cornell Univ., USA; Gleeson, Ronald F., Trenton State Coll., USA; Williams, Robert M., Naval Air Warfare Center, USA; Aug. 02, 1996; 44p; In English

Report No.(s): AD-A320264; NAWCADPAX--96-220-TR; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The Navy utilizes matrices to analyze radar signals to determine the direction and velocity of aircraft. Matrix analysis is also useful in the sonar classification of submarines. One powerful tool for obtaining information about matrices is wedge theory. (The traditional terminology is compound matrix theory, whereas modern texts speak of mappings on the exterior algebra.) Wedge theory is a fundamental tool in multilinear algebra with important applications to group representations and tensor analysis. Current research indicates that it may also be useful in analyzing noisy data matrices, but this potential has not yet been fully explored. The purpose of this report is to collect details about wedge theory, in one accessible place, to facilitate future exploration of this topic. First, basic properties of the wedge operation are given along with definitions and examples. Then, an application to calculating the rank of a matrix with noise is considered. Finally, since the basic constructions can now be easily implemented on desktop computer algebra systems, the procedures for several such packages are illustrated.

DTIC

*Matrices (Mathematics); Signal Processing; Data Management*

**19970020117** Wright Lab., Control Analysis Section, Wright-Patterson AFB, OH USA

**Bifurcation Stabilization with Local Output Feedback**

Gu, Guo-Xiang, Louisiana State Univ., USA; Chen, Xiang, Louisiana State Univ., USA; Sparks, Andrew G., Wright Lab., USA; Banda, Siva S., Wright Lab., USA; Jun. 1996; 13p; In English

Report No.(s): AD-A320238; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Local output feedback stabilization with smooth nonlinear controllers is studied for parameterized nonlinear systems for which the linearized system possesses either a simple zero eigenvalue, or a pair of imaginary eigenvalues, and the bifurcated solution is unstable at the critical value of the parameter. It is assumed that the unstable mode corresponding to the critical eigenvalue of the linearized system is not linearly controllable. Two results are established for bifurcation stabilization. The first one is stabilizability conditions for the case where the critical mode is not linearly observable through output measurement. It is shown that nonlinear controllers do not offer any advantage over the linear ones for bifurcation stabilization. The second one is stabilizability conditions for the case when the critical mode is linearly observable through output measurement. It is shown that linear controllers are adequate for stabilization of transcritical bifurcation, and quadratic controllers are adequate for stabilization of pitchfork and Hopf bifurcations, respectively. The results in this paper can be used to synthesize stabilizing controllers, if they exist.

DTIC

*Control Systems Design; Stabilization; Branching (Mathematics); Nonlinear Systems; Controllers; Feedback Control*

**19970020118** Wright Lab., Wright-Patterson AFB, OH USA

**An LMI Formulation of Robustness Analysis for Systems with Time-Varying and LTI Uncertainty**

Sparks, Andrew G., Wright Lab., USA; Blue, Paul A., Wright Lab., USA; Banda, Siva S., Wright Lab., USA; Jan. 1996; 11p; In English

Report No.(s): AD-A320242; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

A procedure is developed to analyze uncertain systems having both time varying (TV) and linear, time-invariant (LTI) uncertainty. The problem is formulated as a two step procedure involving the solution of two sets of LMIs using both constant and frequency dependent scales to account for the different types of uncertainty. In the first step, the scales corresponding to the TV parameters are constrained to be constant over a set of frequencies and both constant and frequency dependent scales are computed to minimize the peak value of the robustness bound for the chosen frequencies. In the second step, the constant scales are held

fixed and the frequency dependent scales corresponding to the LTI uncertainty are computed to minimize the robustness bound at each frequency. Numerical examples are given to demonstrate the procedure, which gives a less conservative result than previously shown and thus allows for more accurate analysis of systems with TV and LTI uncertainty.

DTIC

*Robustness (Mathematics); Systems Analysis; Control Theory*

**19970020180** Minnesota Univ., Dept. of Computer Science, Minneapolis, MN USA

**An Efficient Newton-Type Iteration for the Numerical Solution of Highly Oscillatory Constrained Multibody Dynamic Systems**

Yen, Jeng, Minnesota Univ., USA; Petzold, Linda, Minnesota Univ., USA; Sep. 18, 1996; 37p; In English

Contract(s)/Grant(s): DAAL03-92-G-0247

Report No.(s): AD-A317005; TR-96-028; ARO-29850.5-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

In this paper we present a coordinate-split (CS) technique for the numerical solution of the equations of motion of constrained multibody dynamic systems. We show how the coordinate-split technique can be implemented within the context of commonly used solution methods, for increase efficiency and reliability. A particularly challenging problem for multibody dynamics is the numerical solution of highly oscillatory nonlinear mechanical systems. Highly stable implicit integration methods with large step-sizes can be used to damp the oscillation, if it is of small amplitude. However, the standard Newton iterations is known to experience severe convergence difficulties which forces restriction of the step size. We introduce a modified coordinate-split (CM) iteration which overcomes these problems. Convergence analysis explains the improved convergence for nonlinear oscillatory systems, and numerical experiments illustrate the effectiveness of the new method.

DTIC

*Equations of Motion; Nonlinear Systems; Mathematical Models; Systems Analysis; Measure and Integration; Oscillations; Iterative Solution*

**19970020231** Minnesota Univ., Dept. of Computer Science, Minneapolis, MN USA

**Convergence of the Iterative Methods for Coordinate-Splitting Formulation in Multibody Dynamics**

Yen, Jeng, Minnesota Univ., USA; Petzold, Linda, Minnesota Univ., USA; Sep. 18, 1996; 29p; In English

Contract(s)/Grant(s): DAAL03-92-G-0247

Report No.(s): AD-A317008; ARO-29850.4-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

In a previous paper, we introduced a coordinate-splitting (CS) form of the equations of motion for multibody systems which together with a modified nonlinear iteration (CM), is particularly effective in the solution of certain nonlinear highly oscillatory systems. In this paper, we examine the convergence of the CS and CM iterations and explain the improved convergence of the CM iteration. An example is given from flexible body simulation which illustrates the convergence results and the class of problems for which the CM iteration is most effective.

DTIC

*Equations of Motion; Iterative Solution; Flexible Bodies; Convergence; Many Body Problem; Nonlinear Systems*

**19970020303** Los Alamos National Lab., NM USA

**Node weighted network upgrade problems**

Krumke, S.O., Wuerzburg Univ., Germany; Noltemeier, H., Wuerzburg Univ., Germany; Marathe, M.V., Los Alamos National Lab., USA; Ravi, S.S., State Univ. of New York, USA; [1996]; 19p; In English; 37; Annual Foundations of Computer Science Conference, 13 - 16 Oct. 1996, Burlington, VT, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): W-7405-ENG-36

Report No.(s): LA-UR-96-1467; CONF-961004-2; DE96-011233; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

Consider a network where nodes represent processors and edges represent bidirectional communication links. The processor at a node  $v$  can be upgraded at an expense of  $\text{cost}(v)$ . Such an upgrade reduces the delay of each link emanating from  $v$  by a fixed factor  $x$ , where  $0 < x < 1$ . The goal is to find a minimum cost set of nodes to be upgraded so that the resulting network has a spanning tree in which edge delay is at most a given value  $\delta$ . The authors provide both hardness and approximation results for the problem. They show that the problem is NP-hard and cannot be approximated within any factor  $\beta$  less than  $\ln n$ , unless NP (improper subset)  $\subseteq \text{DTIME}(n^{\sup \log \log n})$ , where  $n$  is the number of nodes in the network. They then present the first polynomial time approximation algorithms for the problem. For the general case, the approximation algorithm comes within a factor of  $2 \ln n$  of the minimum upgrading cost. When the cost of upgrading each node is 1, they present an approximation algo-

rithm with a performance guarantee of  $4(2 + \ln(\Delta))$ , where  $\Delta$  is the maximum node degree. Finally, they present a polynomial time algorithm for the class of treewidth-bounded graphs.

DOE

*Communication Networks; Data Transmission; Algorithms; Approximation*

## 65

### STATISTICS AND PROBABILITY

*Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.*

**19970019743** Florida State Univ., Gainesville, FL USA

**Problems in Probability, Statistics and Reliability Final Report, 1 May 1993 - 1 Jul. 1996**

Sethuraman, Jayaram, Florida State Univ., USA; Aug. 18, 1996; 8p; In English

Contract(s)/Grant(s): DAAL04-93-G-0201

Report No.(s): AD-A316857; ARO-31029.6-MA; No Copyright; Avail: CASI; A02, Hardcopy; A01, microfiche

Research was carried out in the area of Reliability, Statistics and Probability. In Reliability, research was carried out in the area of repairable systems. In the area of Statistics, fundamental theoretical results were established concerning Markov chain Monte Carlo methods; such methods have found extremely wide range of applications. Combining work in the area of Probability, many useful results have been obtained in the area of Image Analysis.

DTIC

*Reliability; Analysis (Mathematics); Probability Theory; Statistical Analysis*

**19970019942** Analytic Sciences Corp., San Antonio, TX USA

**A Comparison of Various Probit Methods For Analyzing Yes/No Data On A Log Scale Interim Report, Sep. 1994 - Sep 1995**

Cain, Clarence P., Analytic Sciences Corp., USA; Noojin, Gary D., Analytic Sciences Corp., USA; Manning, Lonnie, Air Force Occupational and Environmental Health Lab., USA; Dec. 1996; 44p; In English

Contract(s)/Grant(s): F33615-92-C-0017; AF Proj. 2312

Report No.(s): AD-A319412; AL/OE-TR-1996-0102; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

A study of the various probit methods to analyze biological data was undertaken to understand the various methods and to determine the requirements for the input data as to distribution, number, and tightness of data for the desired results. Calculations were run for many data sets, and results were compared. Graphical analysis and the Karber method were used along with the SAS Probit Procedure and EZ-Probit. All four methods provided very close agreement on most data sets, and the EZ-Probit program provided almost identical information to the SAS Probit Procedure. Real biological data sets were used for comparison purposes, and three other data sets were made up to simulate real data (with variations in the number and distribution of data points). Fiducial limits at the 95% confidence level were also calculated and compared. For those data sets which had no fiducial limits with SAS Probit at the 95% confidence interval, 85% confidence levels were calculated with the EZ-Probit method because it is not possible to adjust the confidence levels with SAS Probit. Different data sets were run in an attempt to minimize the amount of additional data points needed for an existing data set to tighten the fiducial limits and to show the correlation with a chi square distribution. Finally, it will be shown that the probability distributions from 0.01 to 0.99 are identical out to four decimal places for the SAS Probit and EZ-Probit and that there are only minor differences in the fiducial limits between the two methods for some data sets. Appendix A contains the program required to run the SAS Probit on a PC computer. The EZ-Probit method is included in Appendix B.

DTIC

*Probability Distribution Functions; Biology*

## 66

### SYSTEMS ANALYSIS

*Includes mathematical modeling; network analysis; and operations research.*

**19970019329** Vought Missiles and Space Co., Dallas, TX USA

**The Patriot PAC-3 Missile Program - An Affordable Integration Approach**

Walters, Ed, Vought Missiles and Space Co., USA; O'Reilly, Patrick, Vought Missiles and Space Co., USA; Sep. 1996; 13p; In English



Report No.(s): AD-A319957; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

The affordable PAC-3 system upgrade approach is based on innovative, joint consolidation and integration of existing industry and government assets. Through the integrated use of a network of geographically dispersed simulation, hardware in the loop, and test facilities, the PAC-3 missile design and performance is being analyzed and verified prior to first missile flight. This process begins with the thorough and rigorous testing of missile components. It then continues with the use of integrated simulations which is a key activity to verify and predict PATRIOT system performance with PAC-3 upgrades. The process is culminated with system level and flight testing conducted at White Sands Missile Range, New Mexico. During the Gulf War, the PATRIOT air defense system made its now-famous battlefield debut against Tactical Ballistic Missiles (TBMs). Through a succession of improvements and modifications to refocus its mission on missile defense, PATRIOT helped defend coalition forces and Israeli territory from Iraqi Scud missile attacks. Despite this success, we realized that we needed to improve lethality (ability to destroy hard TBM warheads), radar detection range, defended area (footprint) and automatic recording of battle data. Improvements to the Engagement Control Station (ECS), radar, missile and launcher were planned to counter the TBM threat. Not only would a new state of the art Hit to Kill (HTK) technology advanced missile need to be developed, but it needed to be quickly and affordably integrated into the existing PATRIOT system.

DTIC

*Patriot Missile; Performance Tests; Surface to Air Missiles; Ballistic Missiles*

**19970019758** RAND Corp., Santa Monica, CA USA

**Airborne Intercept: Boost- and Ascent-Phase Options and Issues**

Vaughan, David R., RAND Corp., USA; Isaacson, Jeffrey A., RAND Corp., USA; Kvitky, Joel S., RAND Corp., USA; Jan. 1996; 42p; In English

Contract(s)/Grant(s): F49642-96-C-0001

Report No.(s): AD-A320002; RAND/MR-772-AF; No Copyright; Avail: CASI; A03, Hardcopy; A01, microfiche

This report documents an analysis of countering theater ballistic missiles (TBMs) by using manned aircraft with onboard radar sensors in an airborne intercept role. Although current defense planning does not anticipate such a role for manned aircraft, more- advanced airborne intercept options harbor significant uncertainties with respect to development, and it remains to be demonstrated that they will prove practicable in the decade ahead. Thus, the approaches we analyzed and similar ones may be revisited as nearer- term options in the future. Moreover, although recent discussions have focused almost exclusively on boost-phase intercept (BPI), ascent-phase intercept (API) has significant operational merits that should not be dismissed wholesale. Indeed, our analysis suggests that the development of a dual BPI-API capability should be strongly considered for the reasons cited in this report. Our approach consists of first describing the factors that bear on the decision to develop airborne interceptors, then assessing three nominal development paths, illustrated in Table S.I. Each path is characterized by the sequence of boosters used for development and for the final (objective) operational system. The paths differ in test and development, early contingency, and final objective capabilities. The first two paths, which start with exoatmospheric API early contingency options and end with endoatmospheric BPI systems, are sometimes called 'grow down' paths, implying that lower-altitude BPI may be pursued later through follow-on development. The final path, which starts with an early BPI capability, is called 'direct.'

DTIC

*Ballistic Missiles; Antimissile Defense; Booster Rocket Engines; Radar Tracking; Airborne Radar*

**19970020199** Duke Univ., Durham, NC USA

**Monte Carlo Studies of Continuous Hamiltonian Systems Coupled to Dissipative Mechanisms *Final Report, 1 Apr. 1993 - 31 Aug. 1996***

Ciftan, Mikael, Duke Univ., USA; Oct. 1996; 7p; In English

Contract(s)/Grant(s): DAAH04-93-D-0002

Report No.(s): AD-A316999; ARO-31093-10-PH; No Copyright; Avail: CASI; A02, Hardcopy; A01, microfiche

My staff research on dissipative Hamiltonian systems has evolved from Quantum Optics into three areas over the past three years, exemplifying the type coherent and incoherent processes which when merged lead to dissipative relaxation: (1) High precision scaling and critical exponent relations were derived for the Heisenberg Ferromagnet which show new details that challenge existing theories. (2) Super-enhanced Backscattering of radiation was observed and explained as due to Fabry-Perot type multi-pass multiple scattering from rough thin films where coherency is broken by the spatial stochasticity of the medium leading to photon localization and the ensuing enhancement. Next we need to take higher order correlations into account to include memory effects akin to hysteresis that we studied in Quantum Optics. (3) Showed the necessity of taking the full potential (as opposed to muffin-tin potentials which are partials of the full potential) in the Wigner-Seitz cells of crystalline solids for the calculation of electronic energy levels, including the role of impurities such as sulfur and boron, and therefrom deriving microscopic stress-strain



tensorial relations to study crack propagation-embrittlement problems at the level of details of bonding orbitals. Next Molecular Dynamics will be performed to show effects of temperature on this micromechanical dynamics.

DTIC

*Monte Carlo Method; Hamiltonian Functions; Quantum Optics; Crack Propagation; Micromechanics; Stochastic Processes; Crystallinity; Thin Films; Surface Roughness; Ferromagnetism*

## 67

### THEORETICAL MATHEMATICS

*Includes topology and number theory.*

**19970020441** Rutherford Appleton Lab., Chilton, UK

**A Complete Leading-Order, Renormalization-Scheme-Consistent Calculation of Small-x Structure Functions, Including Leading- $\ln(1/x)$  Terms**

Thorne, Robert S., Rutherford Appleton Lab., UK; Jan. 1997; ISSN 1358-6254; 115p; In English

Report No.(s): RAL-TR-96-065; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, microfiche

We present calculations of the structure functions  $F^{(2)}(x, Q^{(2)})$  and  $F^{(L)}(x, Q^{(2)})$ , concentrating on small  $x$ . After discussing the standard expansion of the structure functions in powers of  $\alpha^{(3)}(Q^{(2)})$  we consider a leading-order expansion in  $\ln(1/x)$  and finally an expansion which is leading order in both  $\ln(1/x)$  and  $\alpha^{(3)}(Q^{(2)})$ , and which we argue is the only really correct expansion scheme. Ordering the calculation in a renormalization-scheme-consistent manner, there is no factorization scheme dependence, as there should not be in calculations of physical quantities. The calculational method naturally leads to the 'physical anomalous dimensions' of Catani, but imposes stronger constraints than just the use of these effective anomalous dimensions.

Author (revised)

*Factorization; Computation; Functions (Mathematics)*

## 70

### PHYSICS (GENERAL)

*For precision time and time interval (PTTI) see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.*

**19970019389** Massachusetts Inst. of Tech., Cambridge, MA USA

**Applications of the Theory of Distributed and Real Time Systems to the Development of Large Scale Timing Based Systems Quarterly Report, 1 Jul. - 30 Sep. 1996**

Lynch, Nancy A., Massachusetts Inst. of Tech., USA; Sep. 1996; 8p; In English

Contract(s)/Grant(s): F19628-95-C-0118

Report No.(s): AD-A317470; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), microfiche

Members of MIT's Theory of Distributed Systems group continued their work on modelling, designing, verifying and analyzing distributed and real time systems. The focus is on the study of "building blocks" for the construction of reliable and efficient systems. These works fall into three general categories: modelling and verification tools, algorithms and impossibility results, and applications.

DTIC

*Real Time Operation; Distributed Processing; Algorithms*

**19970019721** Virginia Polytechnic Inst. and State Univ., Electro Magnetic Interactions Lab., Blacksburg, VA USA

**Rough Surface Scattering Studies Using the Method of Smoothing Final Report, 1 Apr. 1992 - 31 May 1996**

Kapp, David A., Virginia Polytechnic Inst. and State Univ., USA; Brown, Gary S., Virginia Polytechnic Inst. and State Univ., USA; May 31, 1996; 5p; In English

Contract(s)/Grant(s): DAAL03-92-G-0099

Report No.(s): AD-A316815; ARO-29633.1-GS; No Copyright; Avail: CASI; A01, Hardcopy; A01, microfiche